KEHUA TECH

String PV Grid-tied Inverter

SPI-B-H Series (175K-250K)

User Manual

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Foreword

Summaries

Thank you for choosing the SPI-B series (175K-250K) string PV grid-tied inverter(Hereinafter referred to as inverter)!

This document gives a description of inverter, including the appearance, features, working principles, installation, electrical connection, operation, maintenance and storage, etc.

Please save the manual after reading, in order to consult in the future.

NOTE
The figures in this manual are just for reference, for details please see the actual product.

Applicable Model

- SPI175K-B-H
- SPI200K-B-H
- SPI225K-B-H
- SPI250K-B-H

Symbol Conventions

The manual quotes the safety symbols, these symbols used to prompt users to comply with safety matters during installation, operation and maintenance. Safety symbol meaningas follows.

Symbol	Description
DANGER	Alerts you to a high risk hazard that could, if not avoided, result in serious injury or death.
WARNING	Alerts you to a medium or low risk hazard that could, if not avoided, result in moderate or minor injury.

Symbol	Description
 CAUTION	Alerts you to a potentially hazardous situation that could, if not avoided, result in equipment damage, data loss, performance deterioration, or unanticipated results.
	Anti-static prompting.
	Be care electric shock prompting.
TIP	Provides a tip that may help you solve a problem or save time.
NOTE	Provides additional information to emphasize or supplement important points in the main text.

Product standard: Q/XMHS 003

Change History

Changes between document issues are cumulative. The latest document issue contains all the changes made in earlier issues.

Issue 001 (2020-06-09)

First issue.

Contents

1 Safety Description

This chapter mainly describes the safety announcements. Prior to performing any work on the device, please read the user manual carefully, follow the operation and installation instructions and observe all danger, warning and safety information, which is to avoid human injury and device damage by irregular operations.

1.1 Safety Announcements

This section mainly describes the safety announcements when operation and maintenance. For details, please refer to safety description in the relevant chapters.

CAUTION

Before operation, please read the announcements and operation instructions in this section carefully to avoid accident.

The promptings in the user manual, such as "Danger", "Warning", "Caution", etc. don't include all safety announcements. They are just only the supplement of safety announcements when operation.

NOTE

Any device damage caused by violating the general safety operation requirements or safety standards of design, production, and usage will be out of Kehua's warranty range.

1.1.1 Use Announcements

DANGER

Don't touch terminals or conductors that is connected with grid to avoid lethal risk!

DANGER

There is no operational part inside device. Please do not open the crust of device by yourself, or it may cause electric shock. The device damage caused by illegal operation is out of the guarantee range.

DANGER

Damaged device or device fault may cause electric shock or fire!

- Before performing any work on the device, please check whether there is no damage or danger in the device visually.
- Check whether the connection for other external devices or circuits is safe.

DANGER

After disconnect the input and output of the inverter, there still has residual energy in the storage capacitor, which may cause electric shock. It can't do the maintenance until all power supply sources are switched off for 30 minutes.

WARNING

Please do not put finger or tool into the rotating fans to avoid human injury or device damage.

Danger of High Temperature

The surface temperature of inverter may reach to 75℃. During running, please don't touch the surface to avoid scald.

CAUTION

No liquid or other objects are allowed to enter the cabinet.

WARNING

In case of fire, please use dry power fire extinguisher. If using liquid fire extinguisher, it may cause electric shock.

1.1.2 PV Array Protection

When install PV array in daytime, it necessary to cover PV array by light-proof material, or the PV array will generate high voltage under sunshine. If touching PV array accidently, it may cause electric shock or human injury!

DANGER

There exists dangerous voltage between the positive and negative of PV array!

When install device, it must disconnect inverter with PV array completely. Set warning mark here to avoid reconnecting.

1.1.3 ESD Protection

CAUTION

To prevent human electrostatic damaging sensitive components (such as circuit board), make sure that you wear a anti-static wrist strap before touching sensitive components, and the other end is well grounded.

1.1.4 Grounding Requirements

WARNING

High leakage risk! Device must be grounded before performing electrical connection. The grounding terminal must be connected to ground.

- When install device, it must be grounded first. When dismantle device, the grounding wire must be removed at last;
- Don't damage the grounding conductor;
- Before operation, it should check the electrical connection to ensure the device is grounded reliably.

1.1.5 Moistureproof Protection

CAUTION

Moisture invasion may cause inverter damage!

Observe the following items to ensure that inverter works normally.

- When the air humidity is more than 95%, don't open the door of inverter;
- In the wet or damp weather, don't open the door of inverter to perform maintenance or repair.

1.1.6 Warning Mark Setting

In order to avoid accident for unwanted person gets close to inverter or makes improper operation, it should observe the following requirements when perform installation, daily maintenance or repair.

- Set warning marks where the switches are to avoid switching them on improperly.
- Set warning signs or safety warning belt in the operation area, which is to avoid human injury or device damage.

1.1.7 Electrical Connection

Electrical connection must be performed according to the description in the user manual and the electrical circuit schematic.

WARNING

The configuration of PV array, grid level, grid frequency, etc. must meet the technical requirements of inverter.

Grid-tied generation should be allowed by the local power supply department and the related operation should be performed by professionals.

All electrical connection must meet the related country and district standard.

1.1.8 Measurement Under Operation

CAUTION

There exists high voltage in the device. If touching device accidently, it may cause electric shock. So, when perform measurement under operation, it must take protection measure(such as wear insulated gloves, etc.)

The measuring device must meet the following requirements:

- The range and operation requirements of measuring device meets the site requirements;
- The connections for measuring device should be correct and standard to avoid arcing.

1.2 Operator Requirements

CAUTION

The operation and wiring for inverter should be performed by qualified person, which is to ensure that the electrical connection meets the related standards.

Before install, operate and maintain device, the operator must understand the safety announcements, know correct operations and be trained strictly.

- Operator should know the structure and working principle of PV grid-tied generation system well.
- Operator must be familiar with the related country and district standard.

2 Overview

This chapter mainly describes product appearance, structure, working principle and communication method, etc.

2.1 Product Intro

The inverter converts the DC energy from PV array into AC energy and then feedbacks to power grid, which is suitable for the large power station grid-tied system. The PV grid-tiedgeneration system consists of PV array, PV grid-tied inverter, transformer (According to practical application) and power distribution system, as shownFigure2-1.

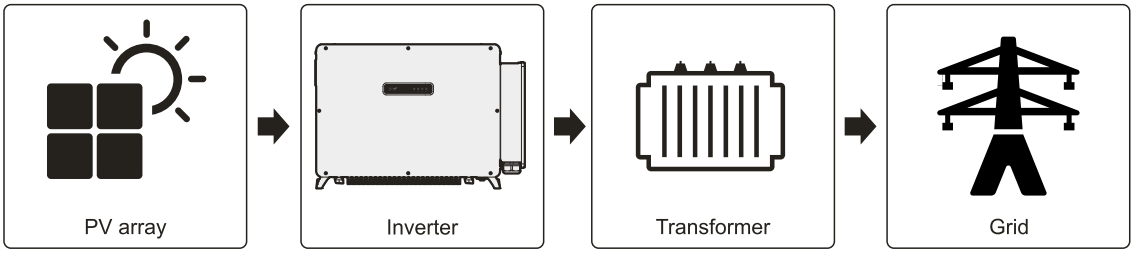


Figure2-1 PV grid-tied generation system

CAUTION

Grid-tied photovoltaic power generation needs to obtain permission from the local power supply department and invite professionals to perform relevant operations.

NOTE

The grid form supported by inverter is shown in Figure2-2.

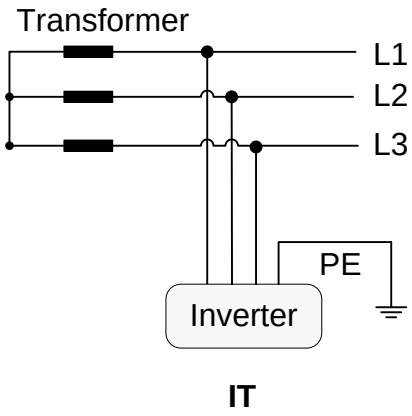


Figure2-2 Grid mode

2.1.1 Features

- Adopts the efficient three level high frequency conversion technology and advanced full digital control technology.
- Good power grid adaptability and excellent power quality.
- The reactive power is adjustable, the range of power factor is -0.8(lag)～+0.8(ahead).
- The active power can be adjusted form 0% to 100% continuously.
- Perfect protection functions: island protection, high/low voltage ride through, reverse DC connection protection, AC short circuit protection, leakage current protection, surge protection, etc.

2.1.2 Model Meaning

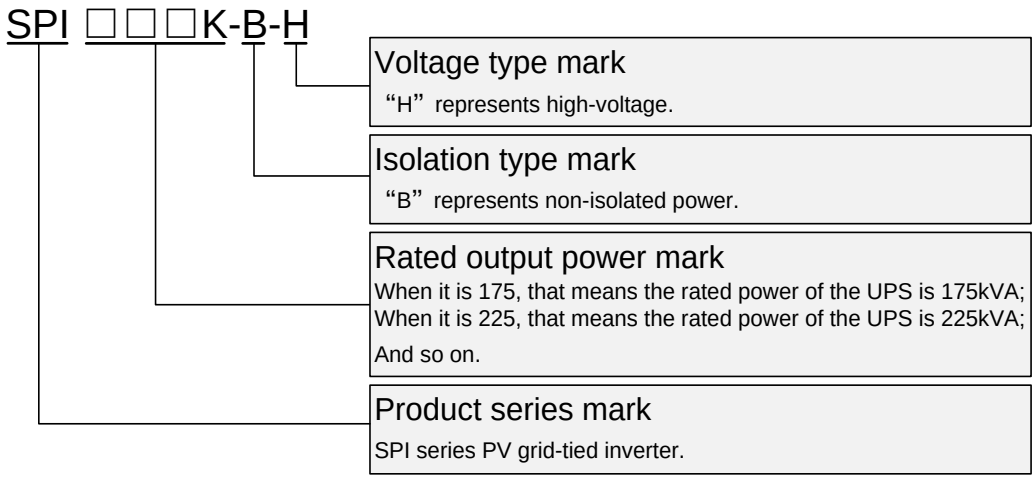


Figure2-3 Model meaning

2.2 Apperance and Structure

2.2.1 Apperance

The appearance of SPI-B-H series string PV grid-tied inverter is as shown in Figure2-4.

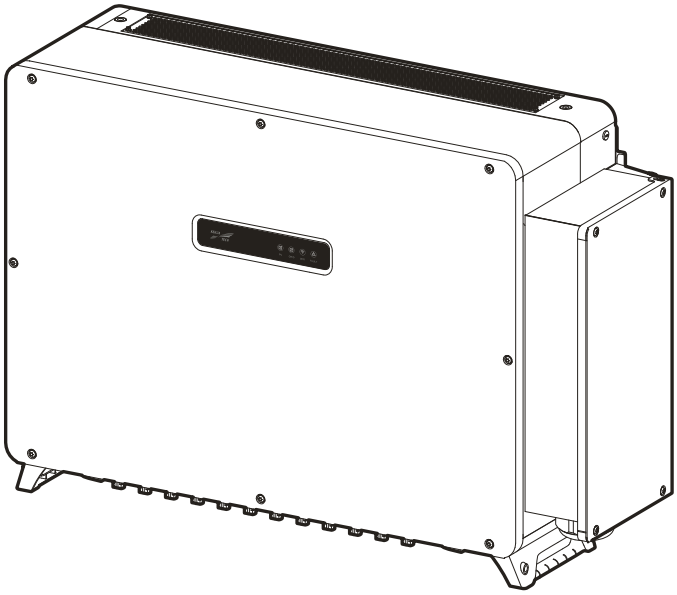


Figure2-4 Appearance

2.2.2 Operation Panel

There are 4 status indicators on the front panel of the inverter, which can indicate the current working status of the inverter. The status of each indicator is shown in Table2-1.

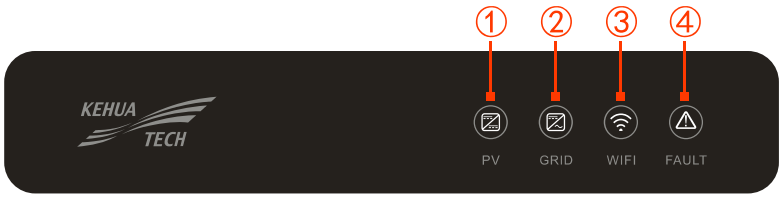


Figure2-5 Operation panel

Table2-1 Indicator status illustration

NO.	Mark	Color	Meaning	Status illustration
①		Green	PV connection indicator	ON: At least a group of PV has been connected.
				Flicker: Night SVG mode grid-tied status
				OFF: All PV are disconnected.

NO.	Mark	Color	Meaning	Status illustration
②		Green	Grid connection indicator	ON: Grid-tied status
				Flicker: Inverter stay in decrease rated power output status
				OFF: No grid-tied status
③		Green	WIFI/GPRS indicator	ON: WIFI/ GPRS has been connected
				OFF: WIFI/ GPRS has been disconnected
④		Red	Fault indicator	ON: The inverter has alarm.

2.2.3 Floor layout

The inverter floor layout is shown as Figure2-6.

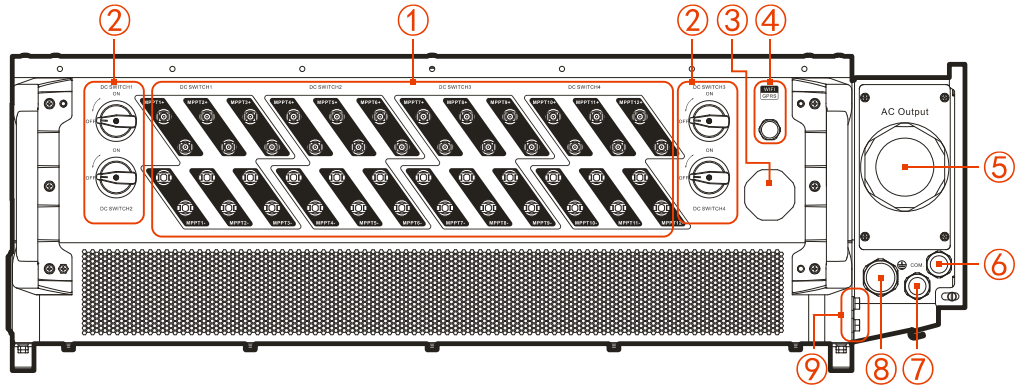


Figure2-6 Floor layout

NOTE

SPI175K-B-H is 18 DC inputs. The connection identifiers MPPT10+ ~ MPPT12+, MPPT10- ~ MPPT12- in Figure 2-6 are not installed with PV connectors, and they are plugged with plugs.

The above picture is illustrated with SPI225K-B-H. If there is no special explanation, the following will take SPI225K-B-H as an example to explain.

Table2-2 Mark description

NO.	Mark	Name	Remarks
①	MPPT n +/MPPT n -	PV string input terminal	Used to connect PV string input.

NO.	Mark	Name	Remarks
②	DC SWITCH	DC switch	Connection switch between inverter and PV string.
③	-	Breathable valve	Balance the pressure difference between inside and outside of the machine.
④	WIFI/GPRS	WIFI/GPRS interface	WIFI/GPRS stick interface and communication
⑤	AC OUTPUT	AC wiring inlet hole	AC output wiring
⑥	COM.	Communication inlet hole	RS485 or Ethernet communication wiring.
⑦			
⑧	⏚	Internal ground inlet hole	For internal ground
⑨		External ground terminal	Used for reliable grounding of the inverter.

DC Switch

The DC switch (the position is shown as ② in Figure2-6) is the connection switch between the inverter and the PV string, and when necessary, it can safely disconnect. In order to ensure the safety of the operator, make sure that the DC switch is turned off under the following conditions:

- When installing the wiring, the DC switch must be placed in the OFF position.
- When checking and repairing, you need to put the DC switch to the OFF position and wait for 30 minutes. Use a multimeter to test that the DC bus voltage inside the machine is below 10V before you can perform repair work.

2.2.4 Dimension

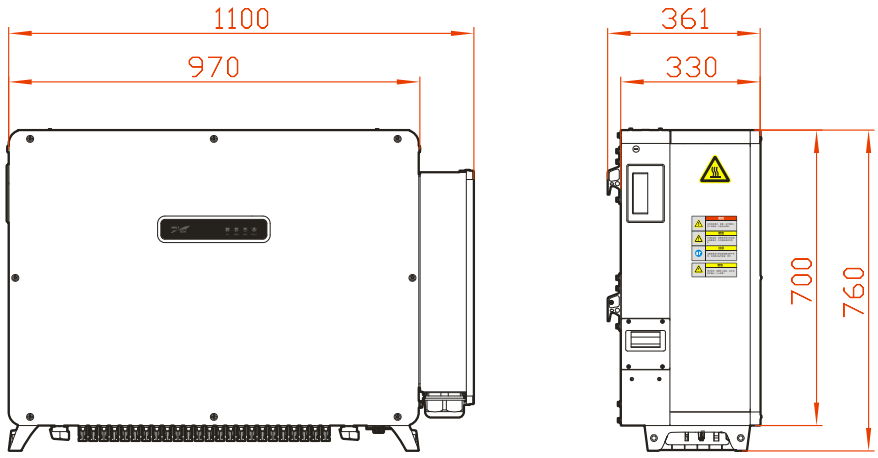


Figure2-7 Inverter dimensions (unit: mm)

2.3 Working Principle

The PV string input is connected to the inverter, and the maximum power point of the PV string is tracked through the internal 12 groups of MPPT circuits to achieve the maximum power output of the photovoltaic string, and then the conversion of DC power to three-phase AC power is realized through the inverter circuit. As shown in 0.

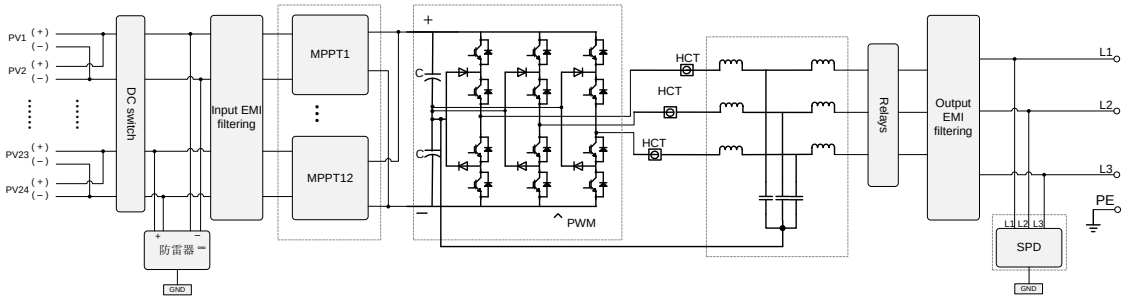


Figure2-8 Working principle diagram

2.4 Communication Method

The inverter has multiple communication methods, including Ethernet communication, RS485 communication, WIFI/GPRS communication (optional), and PLC communication (optional). Users can easily obtain the current system operation data of the inverter.

2.4.1 Ethernet Communication

Ethernet communication (the interface location is shown in Figure2-9) is mainly used for local area network monitoring, which can realize the remote monitoring.

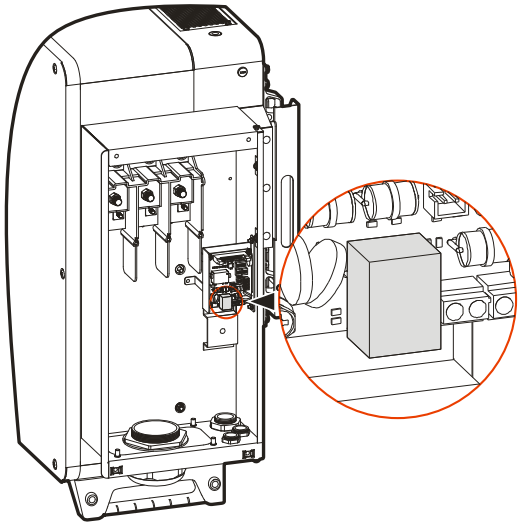


Figure2-9 Ethernet communication interface location

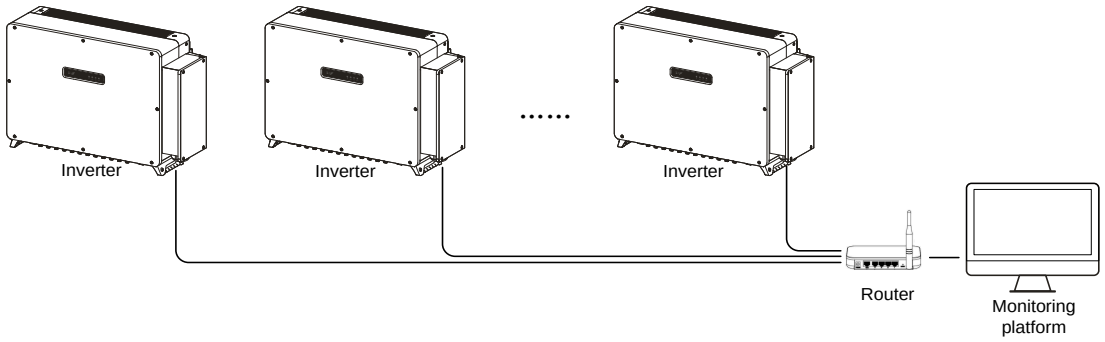


Figure2-10 Ethernet monitoring (multiple inverters)

2.4.2 RS485 Communication

RS485 communication (the interface location is shown in Figure2-11) is mainly used for local area network monitoring, which can realize the remote monitoring.

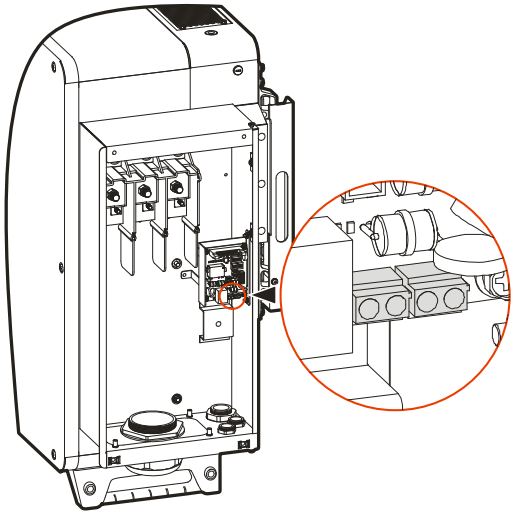


Figure2-11 RS485communication interface location

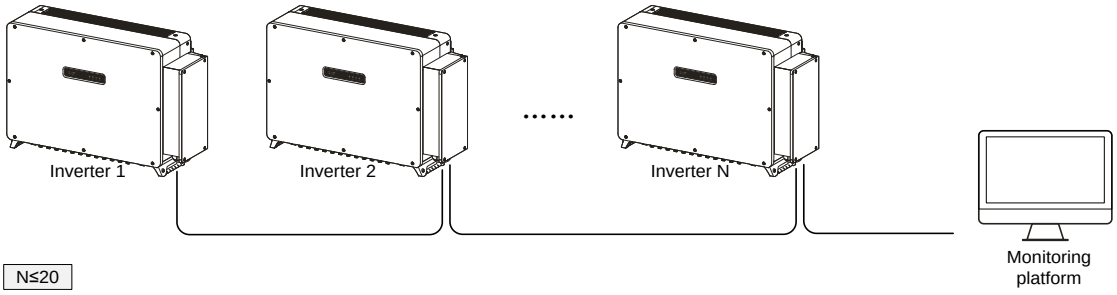


Figure2-12 RS485 communication (multi-unit inverters)

NOTE

When only one inverter communicates via RS485, choose one of the two communication interfaces to connect.

2.4.3 WIFI/GPRS Communication (Optional)

WIFI/GPRS communication is mainly used for remote monitoring, and the running information of the inverter can be monitored through the mobile phone APP. WIFI/GPRS interface location is shown as ④ in Figure2-6.

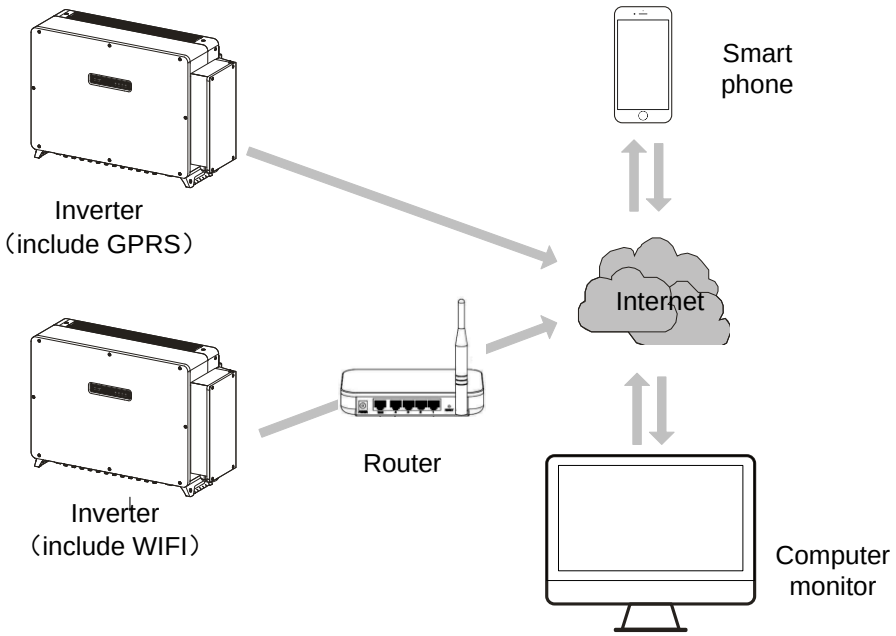


Figure2-13 WIFI/GPRS monitoring solution

2.4.4 PLC Communication (Optional)

If the inverter is equipped with PLC communication, Kehua sub-array controller needs to be configured. The output end of the machine must pass through the isolation transformer and then be connected to the power grid, as shown in Figure2-14.

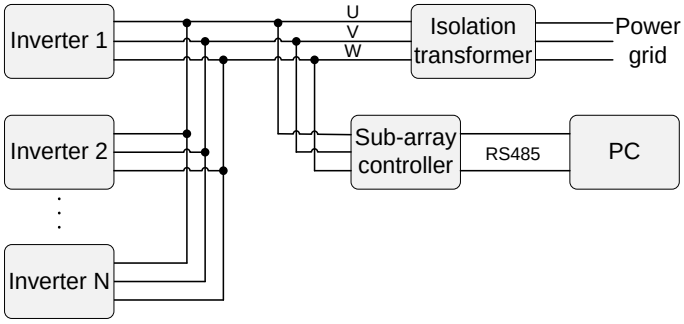


Figure2-14 PLC communication connection

NOTE

PLC communication address setting method is the same as RS485, see***3.6.8 Safety Description*** for details.

3 Installation

This chapter mainly introduces the inverter's installation, including installation process, installation preparation, handling, unpacking and checking, installation procedures, electrical connection. check the installation ,etc.

3.1 Installation Process

The installation process of inverter is as shown in Figure3-1.

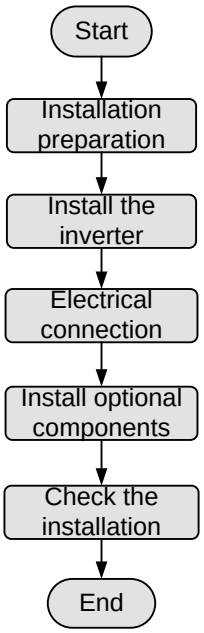
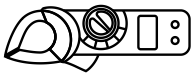
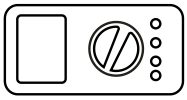
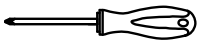
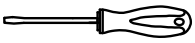
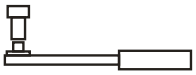
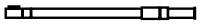
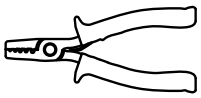
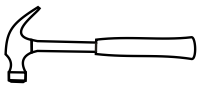
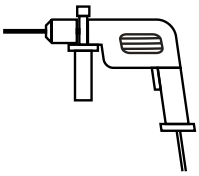
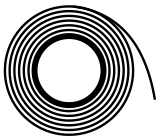
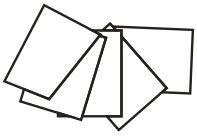
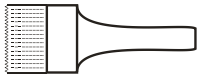
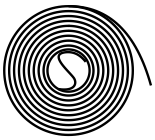
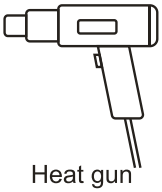
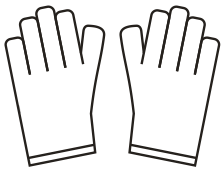
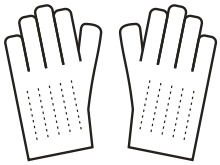
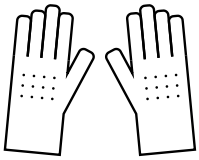
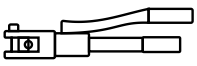
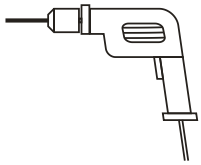
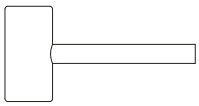


Figure3-1 Installation process

3.2 Installation Tools

The recommended installation tools include but not limited to the following tools, if necessary, you can also use other auxiliary tools according to the site conditions.

Tools			
 Clamp meter	 Multi-meter	 Label paper	 Phillips screwdriver
 Flat-headscrewdriver	 Socket wrench	 Adjustable wrench	 Torque wrench
 COAX crimping tool	 Diagonal pliers	 Wire stripper	 Claw hammer
 Hammer drill	 Insulation tape	 Cotton cloth	 Brush
 Heat shrink tubing	 Heat gun	 Electrician's knife	 Protective gloves
 ESD gloves	 Insulated gloves	 Hydraulic pliers	 Cable tie

Tools			
 Electric drill	 Rubber hammer	 Wrench	

CAUTION

The installation tools need to be insulated to avoid electric shock.

NOTE

Multimeter range≥1500Vdc.

Wrech specification: T30.

3.3 Selection of installation site

3.3.1 Installation Environment

The use environment has a certain influence on the service life and reliability of the equipment. Therefore, please pay attention to avoid using the equipment in the following working environment.

- Do not install the inverter in high or low temperature or humid places that exceed the technical specifications (temperature: -35℃~60℃, relative humidity: 0%~100%)
- Do not install the inverter in an airtight closed space to ensure that the air around the inverter has a certain mobility.
- There must be no flammable or explosive materials or places with dust, corrosive substances, or salt in the installation environment

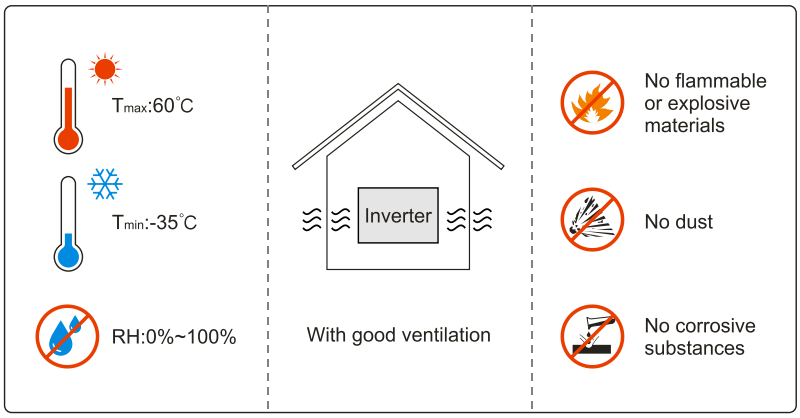


Figure3-2 Installation environment requirements

- As the operation of inverter will produce noise pollution, thus avoid installing them near residential areas as much as possible.

NOTE

Choose the best installation location for the inverter, which plays a very important role in its safe operation, service life, performance guarantee, etc. Therefore, it is recommended to choose a location that can avoid direct sunlight, rain, and snow. As shown in Figure3-3.

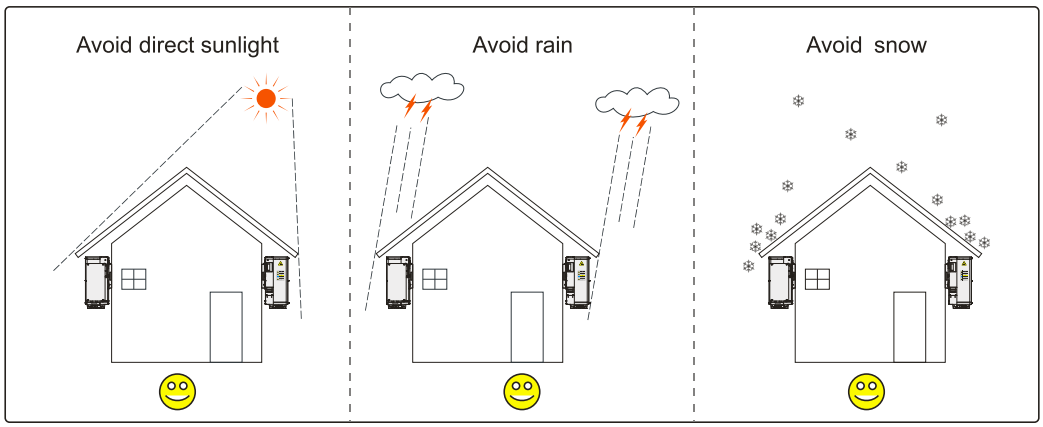


Figure3-3 Recommended installation location

3.3.2 Installation Clearance

- Keep a clearance of at least 800mm from the left side and right side of inverter to other objects, at least 600mm from the top of inverter to ceiling and at least 450mm from the bottom of inverter to ground, which is good for heat dissipation or maintenance, as shown in Figure3-4.

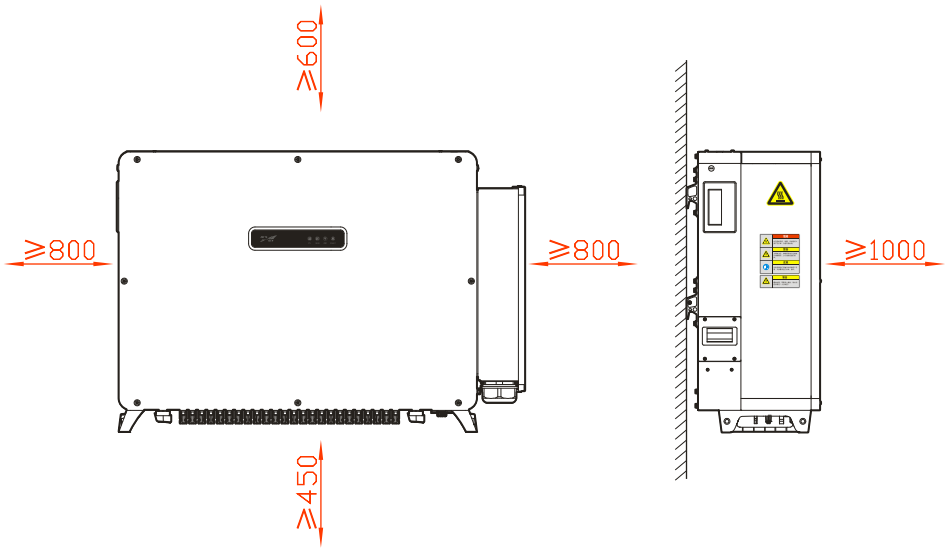


Figure3-4 Installation clearance

NOTE

The installation height of the inverter should be easy to check the status of the indicator lights, and it is convenient for electrical connection, operation and maintenance, etc.

- When multiple inverters are installed side by side, a certain distance must be reserved between the inverters, as shown in Figure3-5.

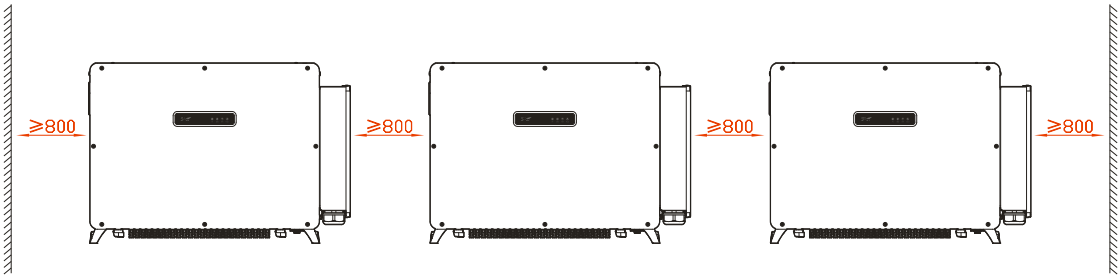


Figure3-5 Installation space requirements of multiple inverters (unit: mm)

- When the inverters are installed back to back, a certain distance must be reserved between the two inverters, as shown in Figure3-6.

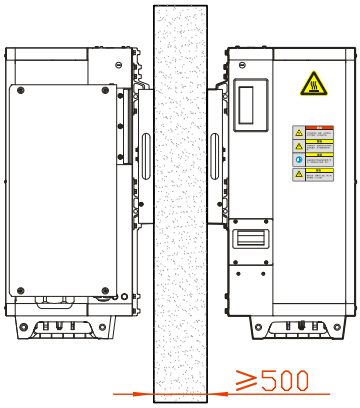


Figure3-6 Back-to-back installation space requirements (unit: mm)

3.3.3 Installation method

It is recommended to install the inverter vertically or obliquely backwards (with an angle of ≤15° from the vertical plane). It cannot be tilted forward, inverted installed.

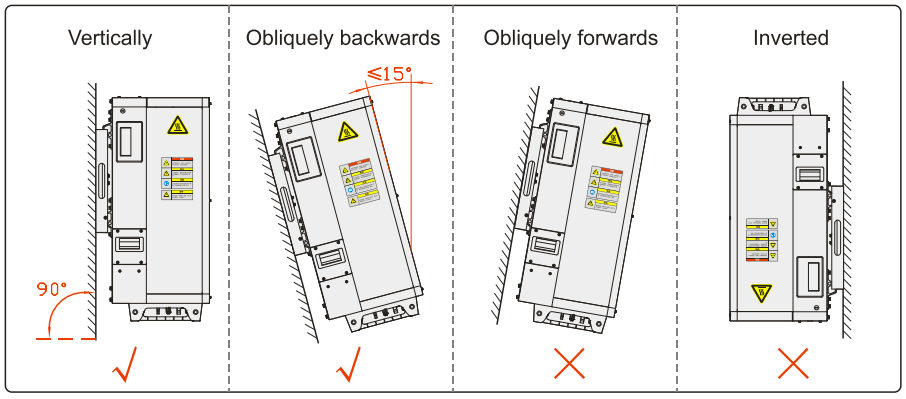


Figure3-7 Illustration of installation method

CAUTION

Because the air duct of the inverter is designed for the downward air inlet and the upper air outlet, in order to ensure the normal operation of the inverter, it is not recommended to install it horizontally.

3.3.4 Installation carrier requirements

The installation carrier of the inverter (such as walls and brackets) should meet the requirements shown in Figure3-8.

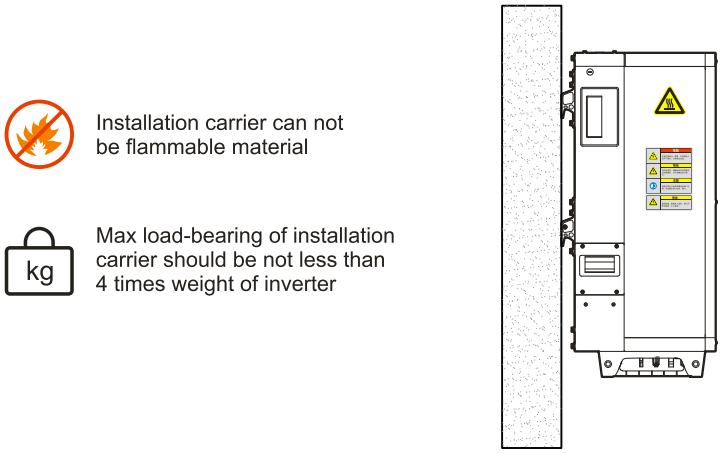


Figure3-8 Installation carrier requirements

3.4 Handling, Unpacking and Checking

3.4.1 Handling

Before installation, the inverter needs to be transported to the selected installation site. When transporting, you can choose to carry the handle or the ring according to the scene.

Handle

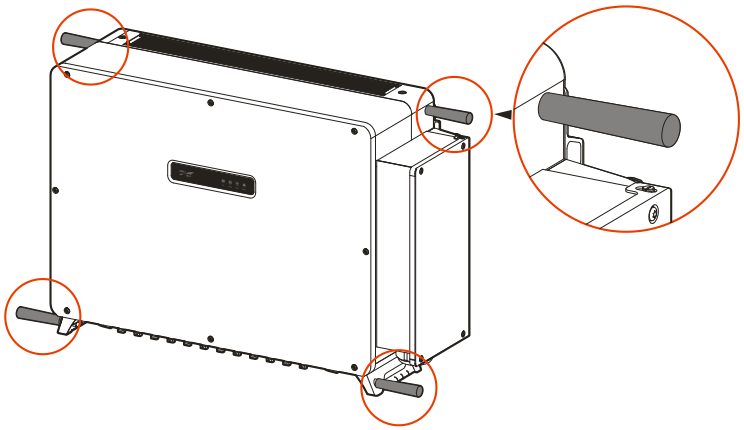


Figure3-9 Curry by handle

NOTE

The handle is a random accessory. When transport the inverter by handle, it needs to be installed the handle in the corresponding position and tightened before lifting.

It is recommended that at least 4 people carry the inverter together and wear protective equipment such as smash-proof shoes and gloves.

CAUTION

- When handling device, move it carefully to avoid impact or fall.
- During the transportation process, always pay attention to the gravity center of the inverter, do not suddenly put down or lift it up.
- Putting the inverter directly on a hard ground will damage the terminals of the case or bottom, and it is necessary to lay protective materials such as sponge pads or foam underneath it.

Ring transport

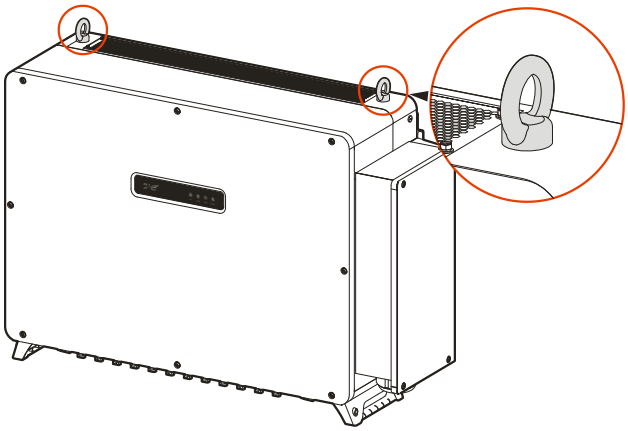


Figure3-10 Ring transport

NOTE

The hoist ring is an optional accessory. When the hoist ring is required for transportation, the hoist ring must be selected first, and installed on the top of the inverter on the site and tightened.

CAUTION

The process of lifting the inverter, you must always maintain balance to avoid collision with walls or other obstacles. In case of severe weather conditions, such as heavy rain, heavy fog, strong wind, etc., the lifting work should be stopped.

3.4.2 Unpacking and Checking

NOTE

Determine the unpacking site in advance. Normally, it's better that the unpacking site is close to installation position.

The inverter has been completely tested and strictly inspected before leaving the factory, but damage may still occur during transportation, so a detailed inspection is required after arrival.

- Inspect the device's appearance for shipping damage, if any shipping damage is found, report it to the carrier immediately.
- Check if the types of the accessories are complete and correct. If there is any discrepancy, take notes and contact the distributor immediately.

CAUTION

After unpacking, if the device should be stored for a long time, it's recommended to pack device with the original package.

----End

3.5 Inverter Installation

The inverter can be installed on the wall or metal holder through equipped installation holder.

3.5.1 Bracket installation

Step 1 Use the four M4*10 combination bolts in the random accessories to fix the wall mount assembly through the connecting rod, as shown in Figure3-11.

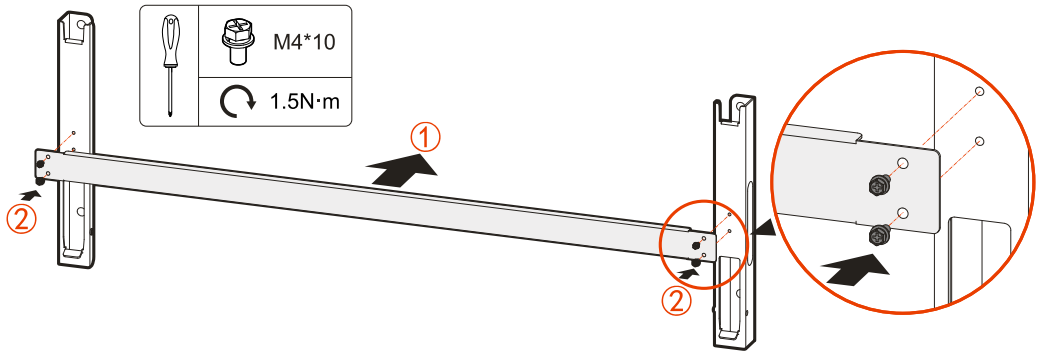


Figure3-11 Assembling the wall mount

Step 2 Place the assembled wall mount at the installation point, use a horizontal ruler to adjust the angle, and mark the position of the hole on the bracket, as shown in Figure3-12.

CAUTION

Please ensure that the wall mount is level to ensure that the mounting holes are consistent and aligned.

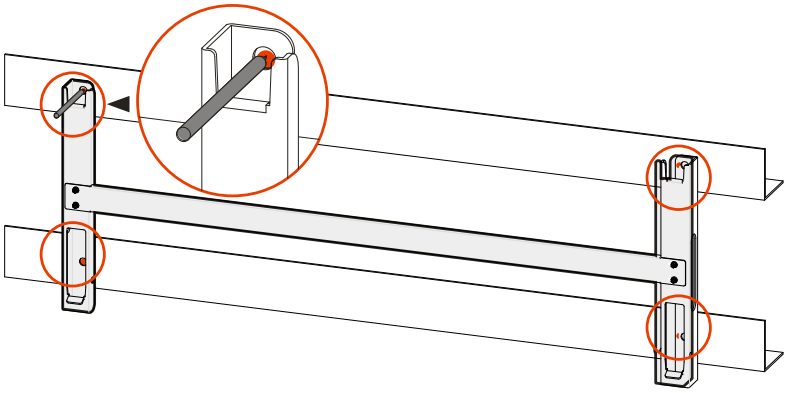


Figure3-12 Mark the mounting holes position

NOTE

You can also directly mark the location of the hole according to the size of the mounting hole of the wall mount (seeFigure3-20).

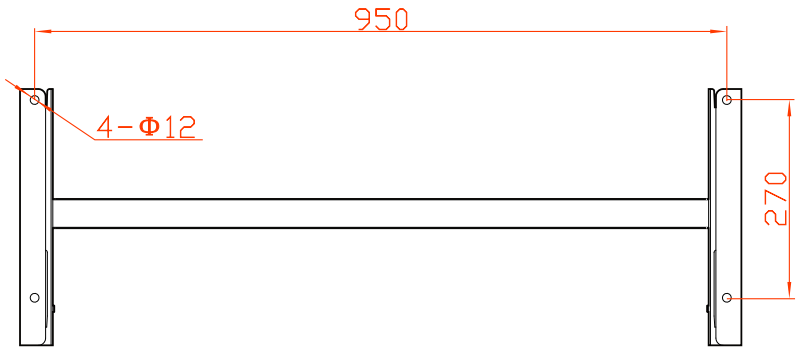


Figure3-13 Mounting hole size (unit: mm)

Step 3 Use the electric drill to drill holes on the bracket according to the marked position. The drilling size is Φ12mm, as shown in Figure3-14.

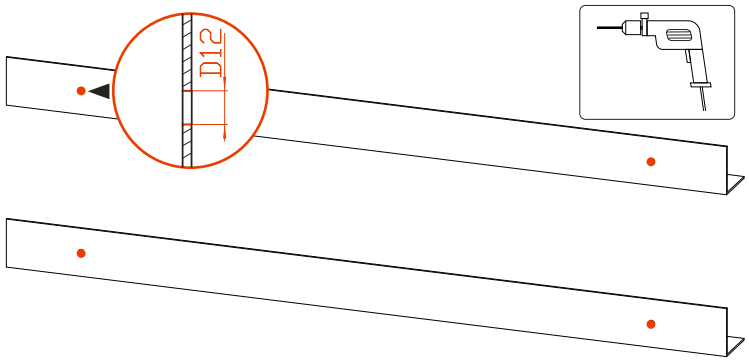


Figure3-14 Drilling holes

Step 4 Fix the wall mount to the bracket, use M10*40 bolts, put on flat washers, spring washers and nuts, and then tighten the nuts clockwise with a wrench to fix the wall mount to the bracket, as shown in Figure3-15.

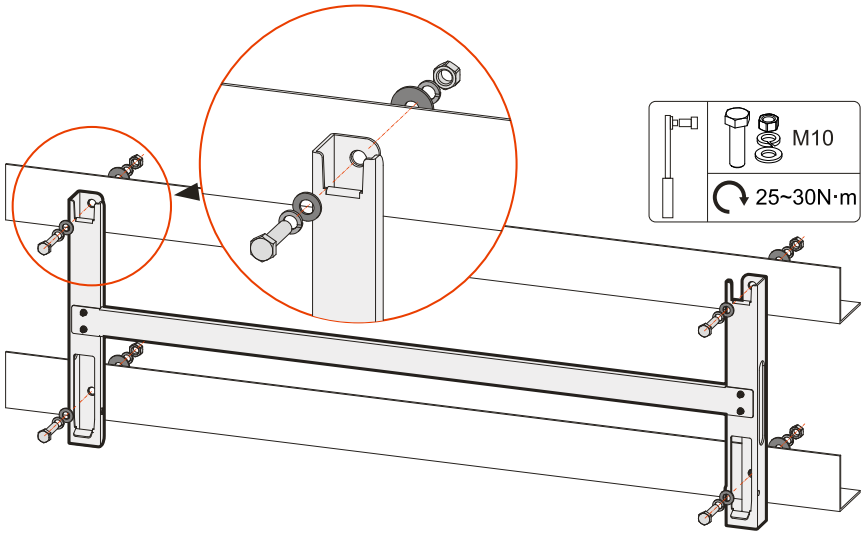


Figure3-15 Fix the wall mount on the bracket

Step 5 Lift the inverter to the wall mount, make sure that the mounting ears and the groove of the wall mount fit well, and then slowly hang the inverter to the wall mount, as shown in Figure3-16.

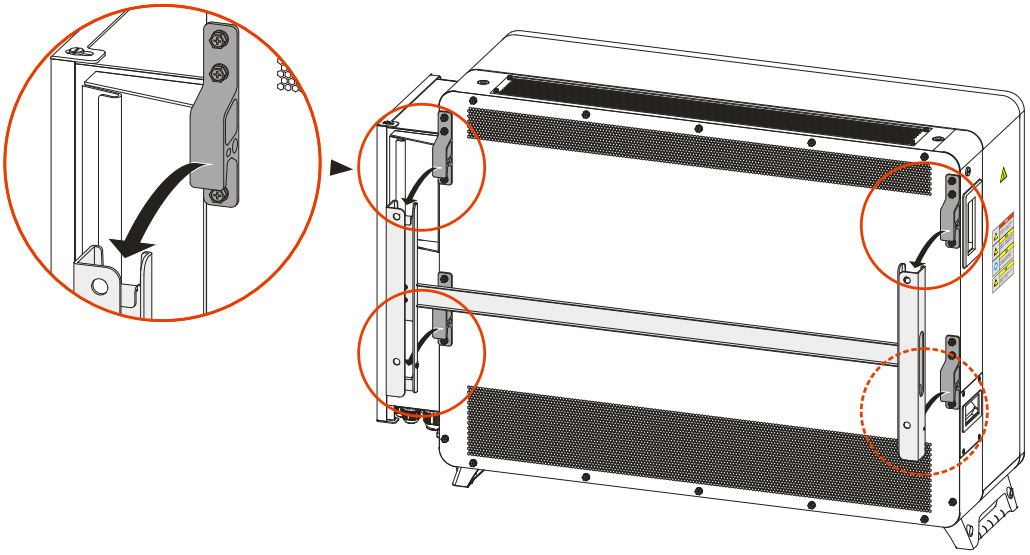


Figure3-16 Hang the inverter on the wall bracket

CAUTION

After confirming that the inverter is fixed firmly, the operator can release the equipment.

Step 6 Use the screws M5*50 in the accessories to fix both sides of the inverter on the wall bracket, as shown in Figure3-17.

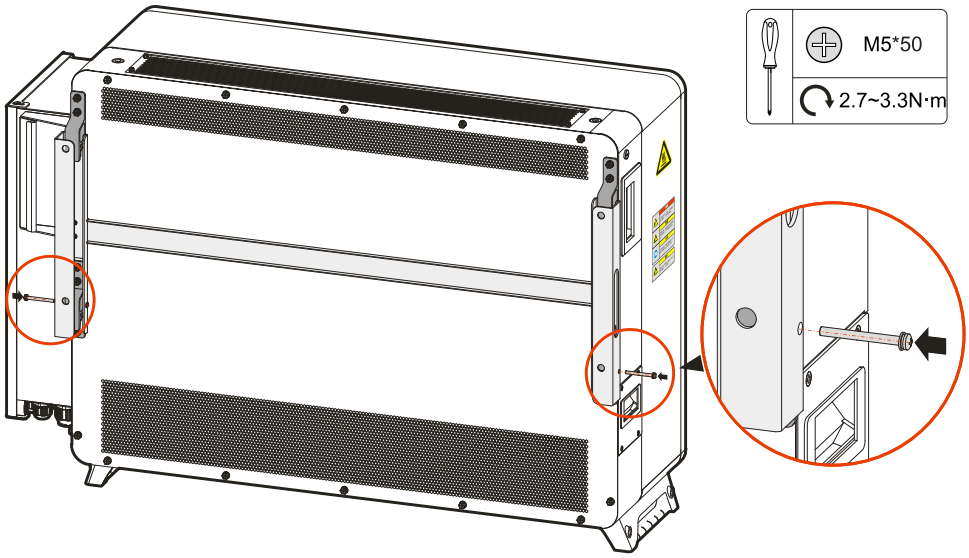


Figure3-17 Inverter fixed

----End

3.5.2 Wall mounting

Step 1 Use four M4*10 combination bolts in the random accessories to fix the wall mount assembly through the connecting rod, as shown in Figure3-18.

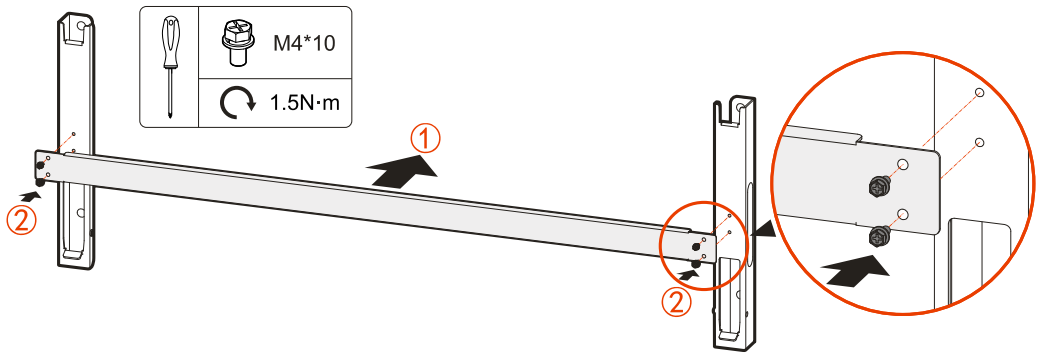


Figure3-18 Assembling the wall mount

Step 2 Place the assembled wall mount at the installation point, use a spirit level to adjust the angle, and mark the location of the hole on the wall, as shown in Figure3-19.

CAUTION

Please ensure that the wall mount is level to ensure that the mounting holes are consistent and aligned.

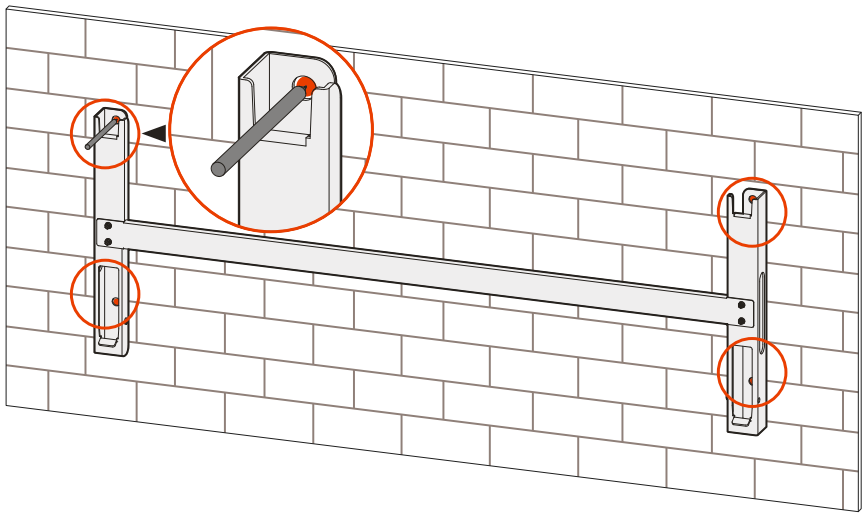


Figure3-19 Mark the mounting holes position

NOTE

You can also directly mark the location of the hole according to the size of the mounting hole of the wall mount (see Figure3-8).

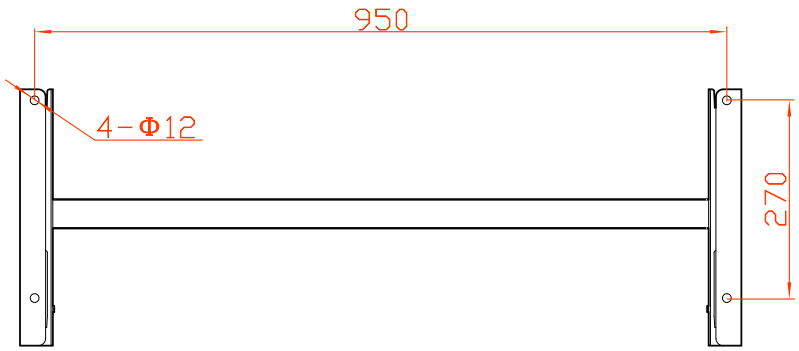


Figure3-20 Mounting hole size(unit: mm)

Step 3 According to the marked position, use a hammer drill to drill holes in the wall. Punching hole size is Φ14.5mm, depth range is 55~60mm.

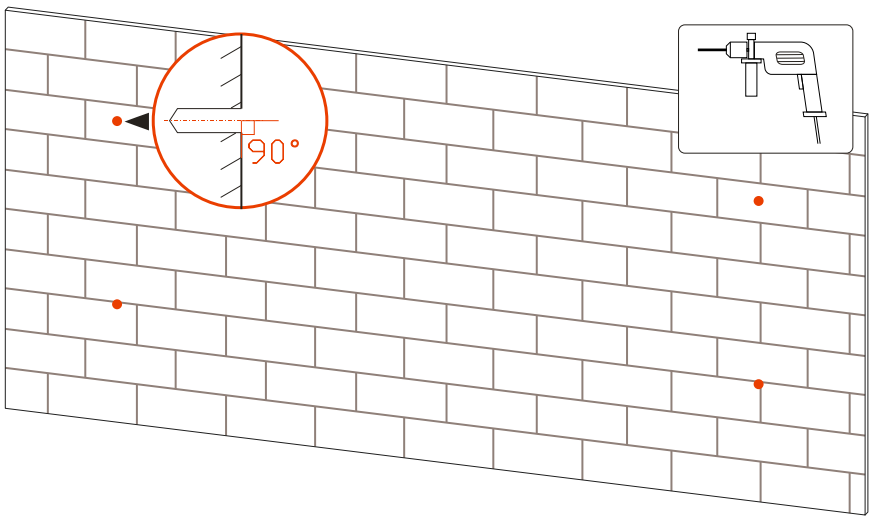


Figure3-21 Punching holes

CAUTION

After drilling the holes, please clean the residues in the holes, and measure the depth of each hole to ensure that the depth of each hole is the same.

Step 4 Install expansion bolts. Install the four M10*80 expansion bolts in the fitting into the installed holes, as shown in Figure3-22.

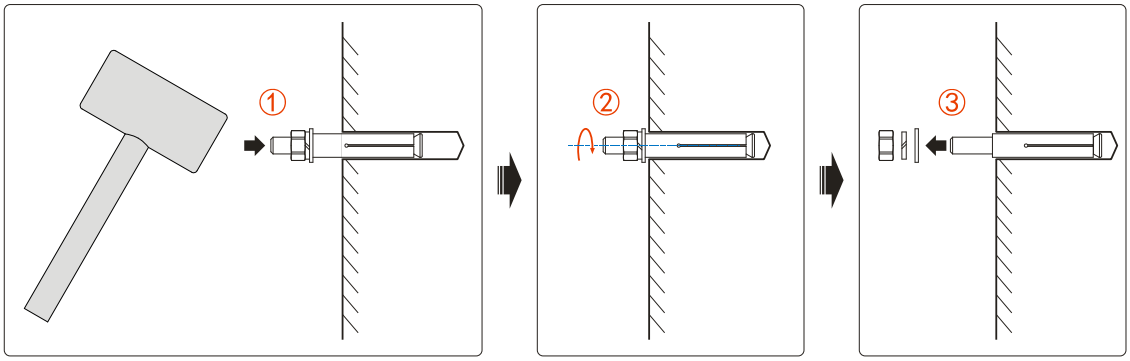


Figure3-22 Expansion bolt installation diagram

Step 5 Install the wall mount. Fix the wall mount to the expansion bolts, cover with flat washers, spring washers and nuts, and then tighten the nuts clockwise with a wrench to fix the wall mount to the wall, as shown in Figure3-23.

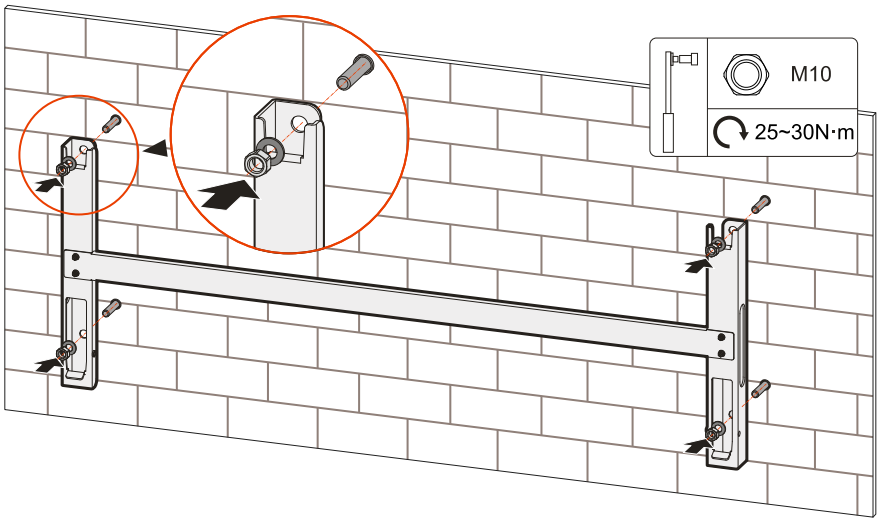


Figure3-23 Fix the wall mount on the wall

Step 6 Lift the inverter to the wall mount, make sure that the mounting ears and the groove of the wall mount fit well, and then slowly hang the inverter to the wall mount, as shown in Figure3-24.

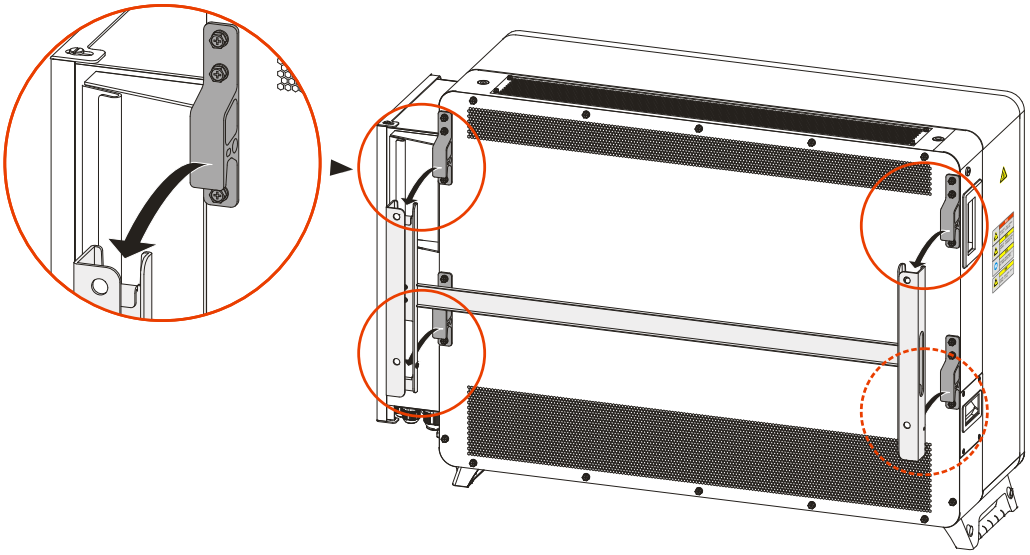


Figure3-24 Hang the inverter on the wall bracket

CAUTION

After confirming that the inverter is fixed firmly, the operator can release the equipment.

Step 7 Use the screws M5*50 in the accessories to fix both sides of the inverter on the wall bracket, as shown in Figure3-25.

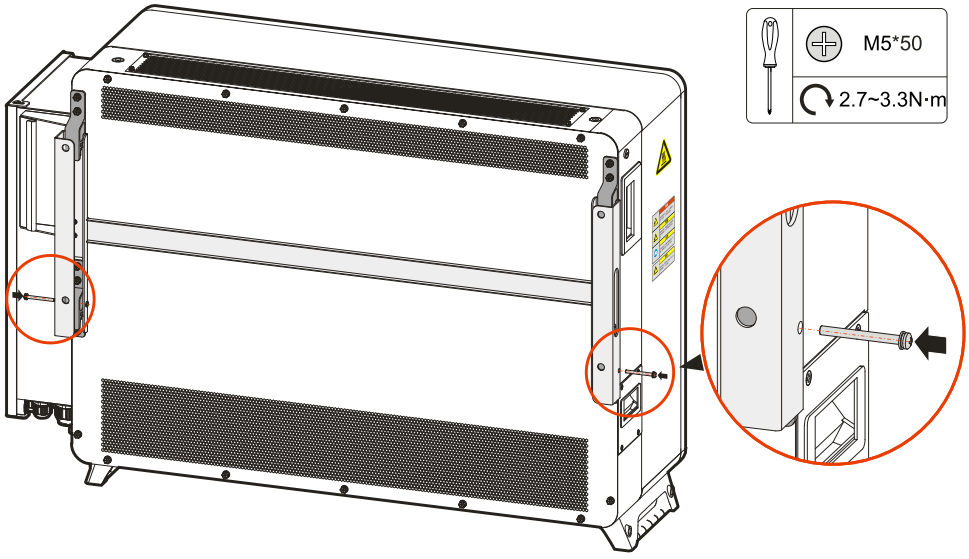


Figure3-25 Inverter fixed

----End

3.6 Electrical Connection

3.6.1 Safety Precautions

During electrical operation, professionals must wear protective equipment.

DANGER

- High voltage may exist in the inverter.
- Photovoltaic strings exposed to sunlight will generate dangerous voltage.
- Do not close the AC and DC circuit breakers before completing the electrical connection.
- Make sure that all cables are not live before making electrical connections.

WARNING

- Any improper operation in the wiring process may cause equipment damage or personal injury.
- Wiring operation must be completed only by professional technicians.
- The cables used in the PV power generation system must be firmly connected, intact, well insulated and of appropriate specifications.

CAUTION

- The wiring process must follow the relevant rules of the local power grid and the relevant safety instructions of the PV string.
- All electrical installations must comply with the electrical standards of the country or local region.
- The inverter can only be integrated into the power grid after obtaining permission from the local power department.

3.6.2 Cable requirements

The wiring terminals are located at the bottom of inverter (as shown in Table3-1), The recommended wire requirements is as shown in Table3-1.

Table3-1 Wire requirements

Name	Type	Recommended wire diameter（mm²）
PV string input cable	1500V and above PV cables	4~6
AC output cable	Outdoor multi-core cable or single-core cable	Outdoor three/four core cable ： 70~240 (Maximum outer diameter<56mm); Outdoor single-core cable：70~300 (Maximum outer diameter<30mm).
Internal ground wire	Outdoor cable	Conductor cross-sectional area≥S/2 (S is the AC output wire conductor cross-sectional area) (Maximum outer diameter <25mm)
Ethernet communication wire	8-core network cable	-
RS485 communication wire	Shielded twisted pair	2*0.3 mm^2（Maximum outer diameter<14mm）
External ground wire	Outdoor cable	Conductor cross-sectional area≥S/2 (S is the AC output wire conductor cross-sectional area)

NOTE

1. The cables in this table are based on UL copper wire. If other wires are used, please replace them according to the standard. The wire materials selected by our company have passed the national standard certification or UL certification. Refer to Table3-1 for the recommended cross-sectional area of the wire when the user purchases the wire by himself (the wire is about 5 meters long).If the wire length exceeds5meters, the cross-sectional area of the wire should be increased accordingly.
2. If the recommended terminal model is not adopted, please confirm with our company.
3. If using the aluminum wire, it should adopt copper-aluminum transition terminal.

3.6.3 External ground connection

WARNING

- Since the inverter is with no transformer, it is required that the positive and negative poles of the photovoltaic string cannot be grounded, otherwise the inverter will not operate normally.
- Before the AC side, photovoltaic string connection and communication connection, please make an external ground connection first.
- The ground connection of the external ground terminal cannot replace the connection of the internal ground terminal. Make sure that both are grounded reliably, otherwise Kehua will not bear any responsibility for possible consequences.

Step 1 Strip the insulation layer of the ground wire with a crimping tool to a suitable length, and press into the corresponding terminal, as shown in Figure3-26.

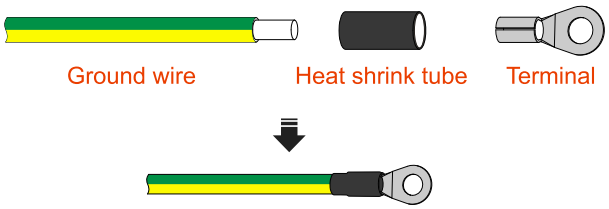


Figure3-26 Ground wire stripping diagram

NOTE

The external ground terminal is recommended to use DT or OT terminal.

Step 2 Connect the crimped ground wire to the external ground terminal at the bottom of the inverter, as shown in Figure3-27.

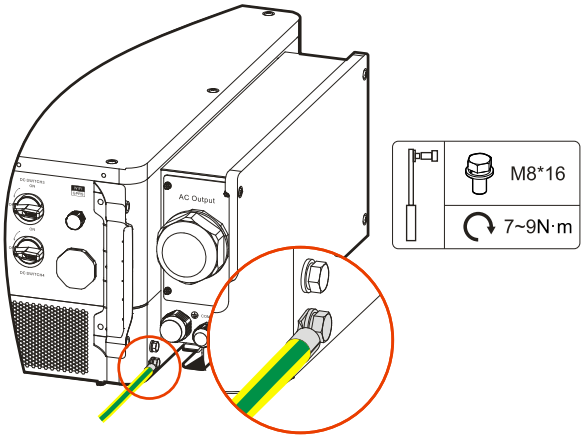


Figure3-27 Schematic diagram of the ground connection

NOTE

Two external ground terminals are reserved at the bottom of the inverter, at least one of them should be selected for grounding.

In order to improve the anti-corrosion performance of the ground terminal, it is recommended to apply anti-rust paint on the outside of the ground terminal for protection after the bottom line is installed.

CAUTION

- The grounding of the inverter and the lightning rod of the inverter installation building cannot be the same, the two need to be separated (as shown inFigure3-28).
- The ground of the inverter should be directly connected to the grounding system, and the impedance is less than 20mΩ.

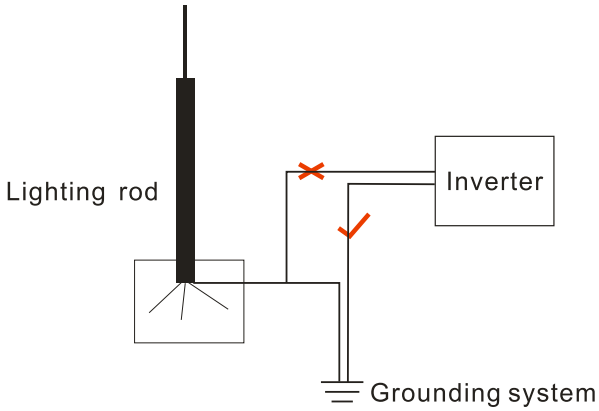


Figure3-28 The grounding of inverter

----End

3.6.4 AC output wiring

CAUTION

Before connecting to the power grid, first make sure that the power grid voltage and frequency meet the requirements of the inverter. For detailed parameters, see ***A Safety Description***. Otherwise, please contact the power company to resolve.

Each inverter is equipped with an independent four-pole circuit breaker on the AC side to ensure that the inverter is safely disconnected from the power grid. Recommended circuit breaker rated voltage is 800V, rated current is 250A.

NOTE

If multiple inverters need to share a circuit breaker, they need to be selected according to the total current.

CAUTION

No load can be connected between the inverter and the circuit breaker.

Terminal requirements

- When the AC output uses copper wire, it is recommended to use DT/OT terminals (as shown in Figure3-29) for the terminal block. The terminal specifications and requirements: 13mm≤A≤ 15.5mm，B≤46mm，C≤22mm.

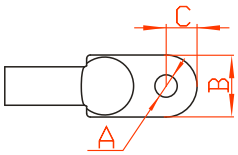


Figure3-29 Terminal size requirements

- When aluminum wire is used for AC output, copper-aluminum transition terminal is required for the terminal to avoid direct contact between the copper bar and the aluminum wire.

Wiring steps

Step 1 Open the cover of the right-side wiring box with an internal torx wrench, as shown in Figure3-30.

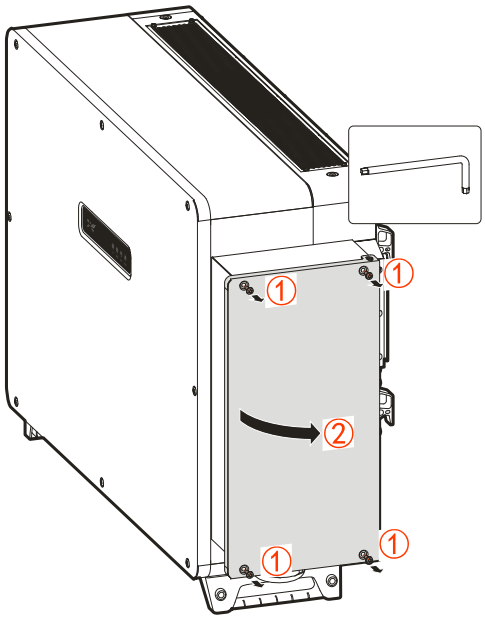


Figure3-30 Open the wiring cover

NOTE

A limited position rod is designed on the inside of the door panel of the wiring box. After the door panel is opened, the limit rod needs to be fixed (as shown in Figure Figure3-31) to facilitate the wiring operation.

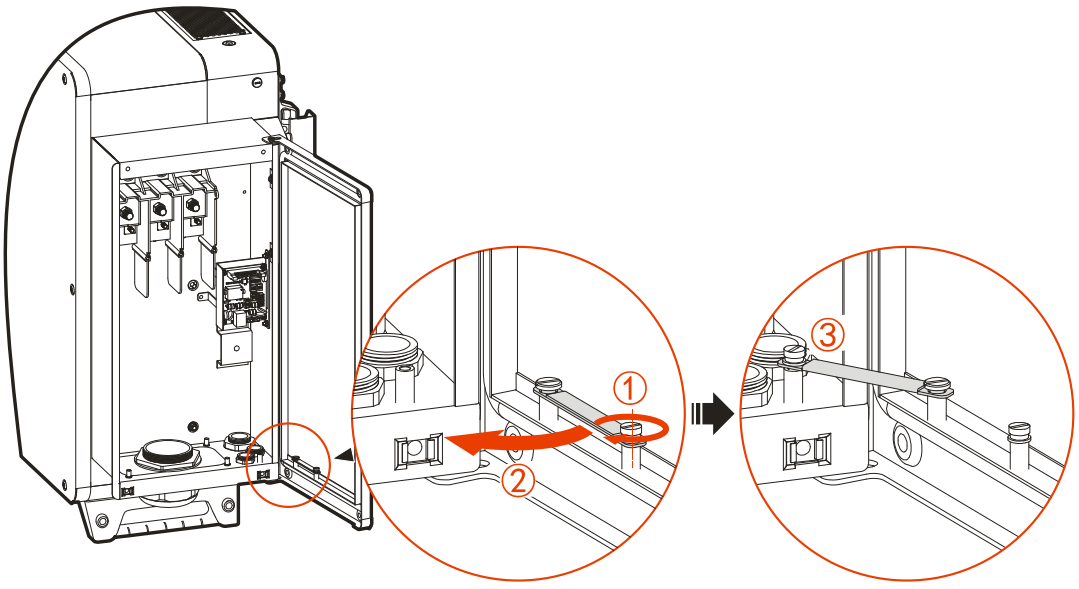


Figure3-31 Schematic diagram of limit rod operation

Step 2 Loosen the external forced cable fixing head of the AC terminal, pass the L1, L2, L3 wires through the external forced cable fixing head through the wiring box, and use a wire stripper to peel off the

AC L1, L2 and L3 respectively, and crimp to the terminal, and then connect to the AC output terminal block, as shown in Figure3-32.

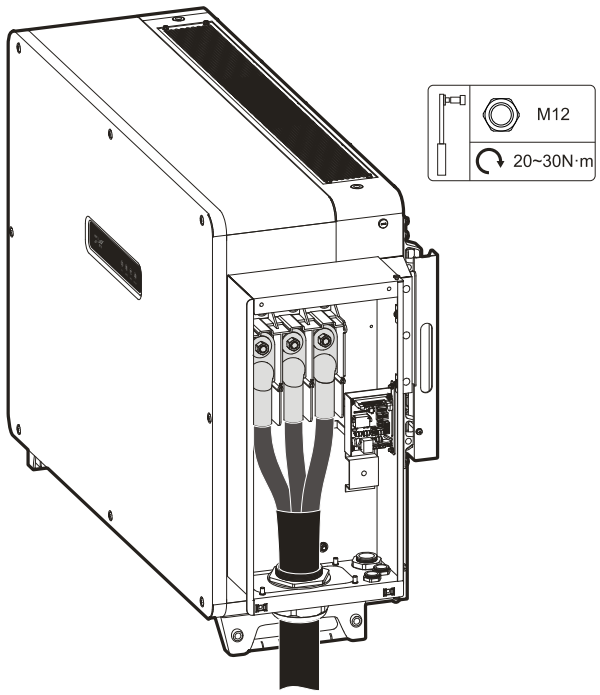


Figure3-32 Connect the AC output cable

说明

The torque used when tightening the externally forced cable fixing head of AC wiring is about 15~19N•m.

CAUTION

In order to avoid excessive stress on the cable, the AC cable needs to enter the box vertically, and the length of the straight section is ≥200mm, as shown in Figure3-33.

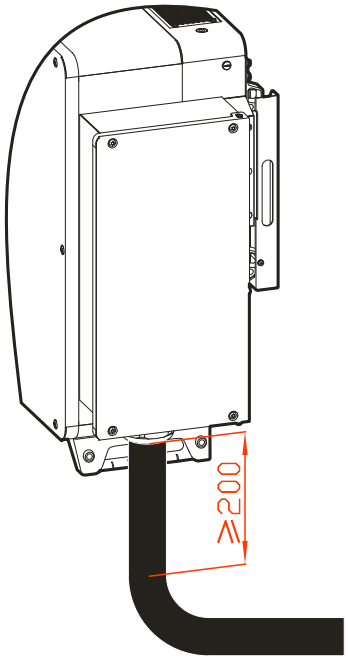


Figure3-33 AC cable entry requirements (unit:mm)

NOTE

- When leaving the factory, one end of the cable seal ring outlet is in a sealed state. Before connecting the cable, the end of the cable seal ring outlet needs to be punctured by a tool
- Please follow the relevant requirements of different countries for AC output wiring.

CAUTION

When the multiple machines are connected in parallel, the back end of the AC output of the inverter needs to be equipped with a circuit breaker with an impact tripping function or an open circuit.

Step 3 Tighten the externally forced cable fixing head of the AC terminal clockwise, using a fireproof mud cable gap.

----End

3.6.5 Internal ground connection

Loosen the external forced cable fixing head outside the internal terminal, pass the ground wire through the external forced cable fixing head through the wiring box, use a wire stripper to strip the appropriate length and crimp it to the ground terminal, and then connect to the inside grounding bar, as shown in Figure3-34.

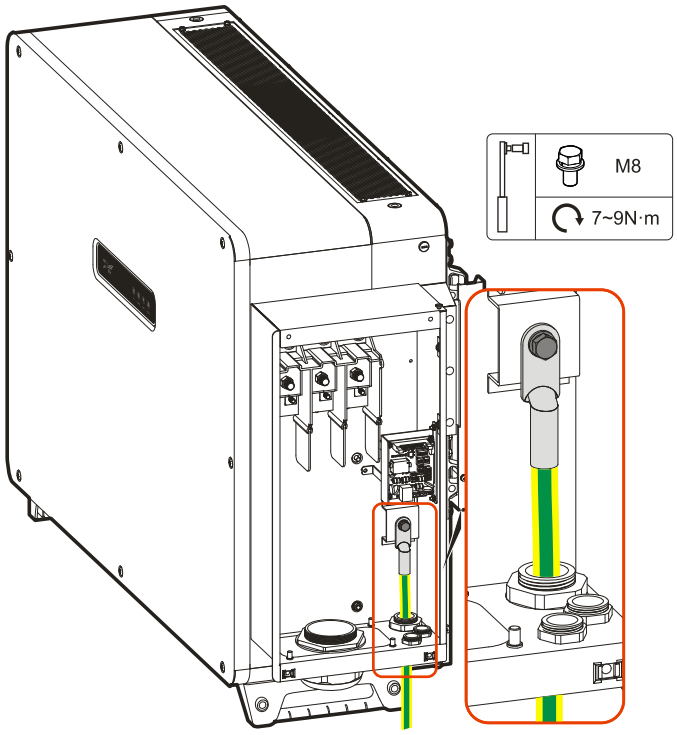


Figure3-34 Connect internal ground

NOTE

The torque used when tightening the externally forced cable fixing head of the internal ground wire is about 10~13N•m.

3.6.6 PV string input wiring

DANGER

Pay attention to safety before electrical connection, the PV string will produce dangerous voltage when exposed to sunlight.

WARNING

If you accidentally reverse the DC input line and the "DC SWITCH" is set to the "ON" position, do not immediately operate the "DC SWITCH" and the positive and negative connectors, otherwise it may cause equipment damage. The resulting equipment damage is not covered by the equipment warranty. Need to wait at night when the solar irradiance decreases and the PV string current drops below 0.5A, then place the two "DC SWITCH" in the "OFF" position, remove the positive and negative connectors to correct the polarity of the DC input polarity.

CAUTION

- Before connecting the PV string to the inverter, ensure that the PV string is well insulated from the ground.
- When installing, you must use the DC terminals and PV connectors in the accessories, otherwise the inverter will be damaged. If accidentally lost or damaged, you need to purchase the same type of photovoltaic connector. Equipment damage caused by the use of incompatible models of photovoltaic connectors is not covered by the equipment warranty.
- Make sure to disconnect the DC switch before connecting the PV string.
- Make sure that the positive and negative poles of the PV string and the inverter are correctly connected.
- Ensure that the DC input voltage is less than 1500Vdc, and the maximum short-circuit current of the PV string is within the allowable range of the inverter.
- The grounding wire of the positive and negative poles of the photovoltaic string is forbidden, otherwise it will cause damage to the inverter.

Use the PV connectors and terminals in the accessories for DC input wiring. There are two types of PV connectors: positive and negative connectors, which respectively use positive metal terminals and negative metal terminals. The specific steps are as follows.

Connect PV connectors

Step 1 Use a wire stripper to strip the insulation of the positive and negative cables by 7mm, as shown in Figure3-35.

Figure3-35 Schematic diagram of stripping DC input wiring (Unit:mm)

NOTE

It is recommended to use red for positive cables and black for negative cables to avoid wiring errors. If other colors are used, please confirm the corresponding relationship when crimping each cable to the connector.

Step 2 Loosen the lock nuts of the positive and negative connectors, pass the positive and negative cables through the corresponding lock nuts, and use a crimping tool to press the positive and negative metal terminals respect to the positive cable and negative cable with the insulation layer removed, as shown inFigure3-36.

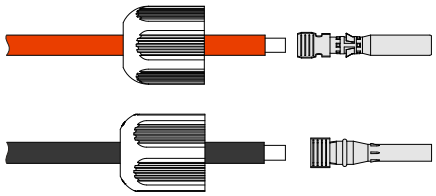


Figure3-36 Crimp metal terminals

Step 3 Insert the crimped positive and negative cables respectively into the corresponding insulating shells until you hear a clicking sound, indicating that complete.

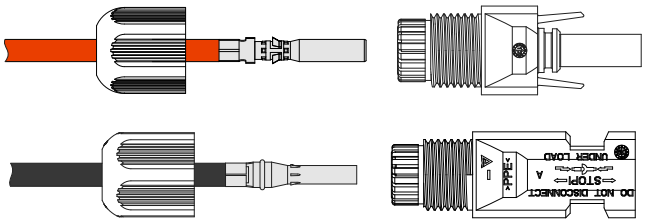


Figure3-37 Fixed metal terminal

Step 4 Turn the locking nuts on the positive and negative connectors respectively to the corresponding insulating shells and tighten, as shown in Figure3-38.

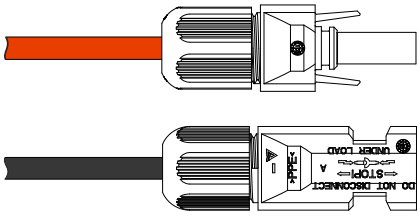


Figure3-38 Tighten the lock nut

----End

Install PV connectors

Step 1 Confirm that all DC switches on the inverter (location is shown as② in Figure3-39) are in the OFF state.

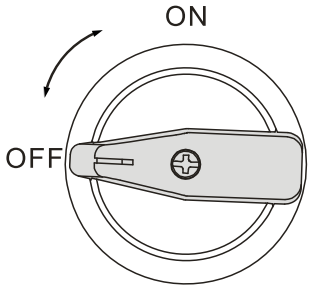


Figure3-39 Schematic diagram of DC switch OFF state

Step 2 Check whether the polarity of the connection cable of the PV string is correct, and ensure that the open circuit voltage in any case does not exceed the maximum input voltage of the inverter 1500V.

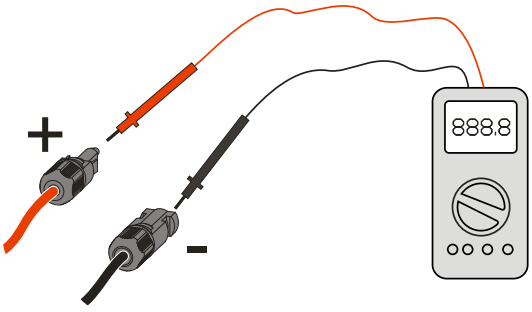


Figure3-40 Measuring open circuit voltage

Step 3 Insert the positive and negative connectors respectively into the MPPT "+" and "-" terminals on the bottom of the inverter (as shown in Figure3-41). When you hear a click, it means that complete.

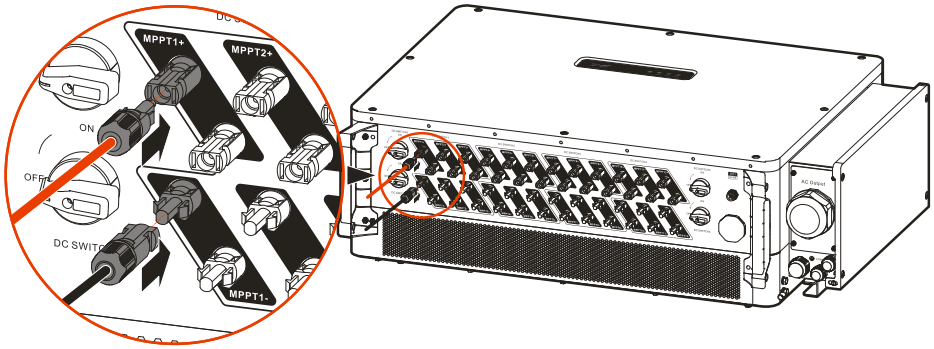


Figure3-41 Connect DC terminal

----End

3.6.7 WIFI/GPRS Communication Connection(Optional)

If there has optional component WIFI/GPRS stick, insert the equipped WIFI/GPRS stick into the WIFI/GPRS port to do the internet monitoring, as shown in Figure3-42.

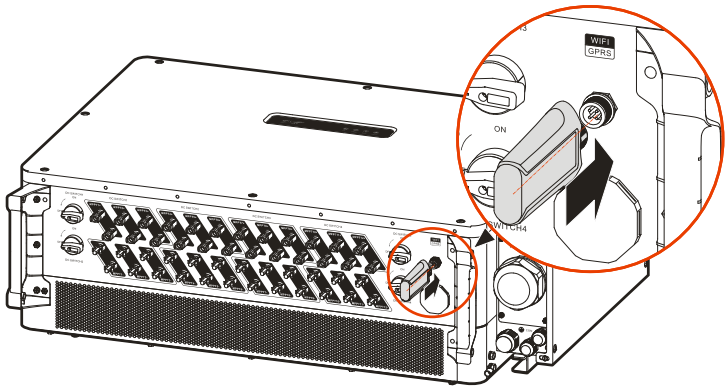


Figure3-42 WIFI/GPRS communication connection

CAUTION

When connecting, pay attention to the limit, and don't insert it wrong. When tightening, do not use excessive force (torque: 1.5~2.0N•m), so as not to damage the interface.

NOTE

1. The GPRS do not need to set.
2. For the use of WIFI and GPRS, please see the built-in user manual in the packaging of WIFI/GPRS.

3.6.8 COM.communication connection

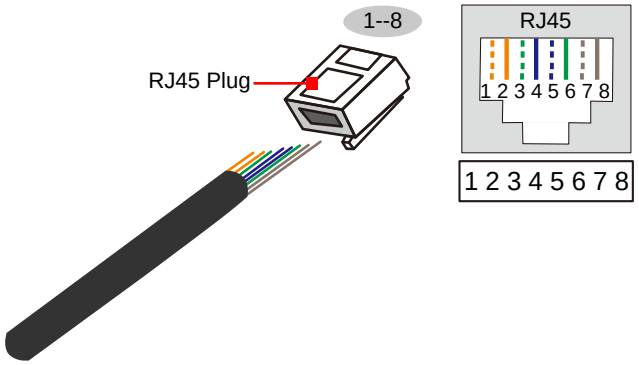
COM. communication includes Ethernet communication and RS485 communication.

Step 1 Loosen the external forced cable fixing head at "COM.", and then pass the communication cable through the external forced cable fixing head.

Step 2 Connect the communication wire

- Ethernet communication connection

Crimp the Ethernet communication cable according to 0, and then plug it into the Ethernet communication interface on the communication board, as shown in Figure3-43 connect the other end to the monitoring platform or router



The correspondence between cable and pin

Pin 1：White and orange； Pin 2：Orange
Pin 3：White and blue； Pin 4：Blue
Pin 5：White and green； Pin 6：Green
Pin 7：White and brown； Pin 8：Brown

Diagram of crimping of Ethernet communication wire

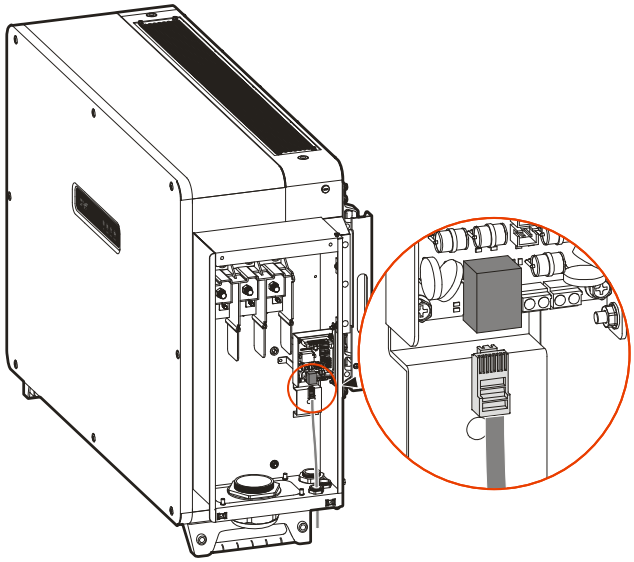


Figure3-43 Ethernet communication connection

- RS485 communication connection

Connect the RS485 communication wires to the RS485 interface on the communication board, as shown in Figure3-44, and connect the other end to the monitoring platform.

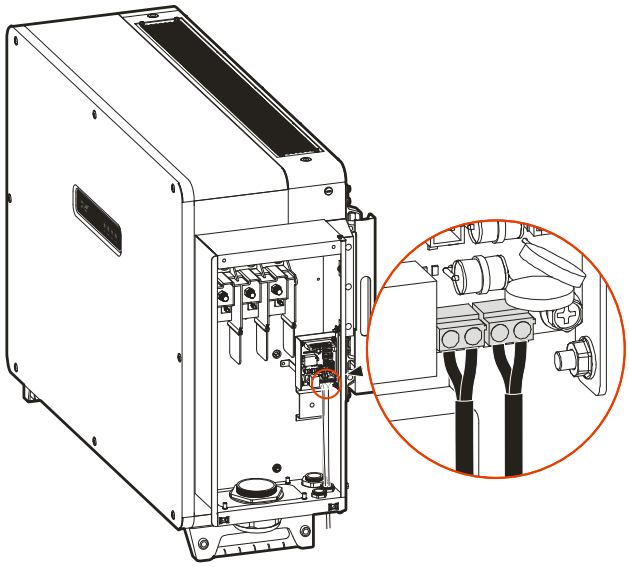


Figure3-44 RS485 connection

CAUTION

- When connecting the terminals, be careful not to press the insulation layer of the communication cable, otherwise it may cause poor contact.
- The RS485 communication wire must be routed separately from the input and output wires to avoid interference with communication.

NOTE

The baud rate of the inverter needs to be set through the Kehua monitoring software WiseEnergy (for details, please refer to the **About-User Manual** in WiseEnergy). The default baud rate is 9600. The communication address of the inverter is set in binary mode through the DIP switch SW1 (position shown in Figure3-45) on the communication board, for example: when the DIP switch SW1 is set to "000001 (from left to right, ON is 1, OFF is 0)", which means the communication address of the inverter is 1, and so on. If in doubt, please contact the manufacturer.

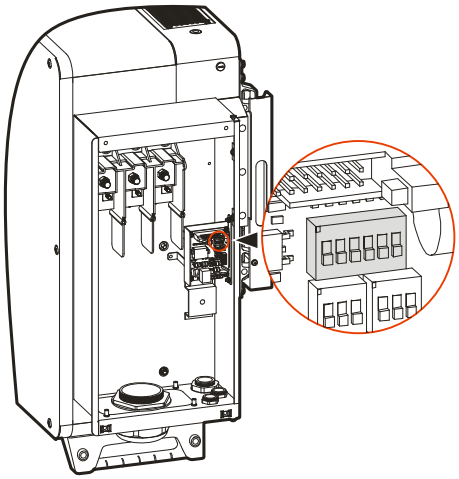


Figure3-45 SW1 position

NOTE

When multiple inverters are communicating, all the DIP switches SW3 on the communication boards of the two inverters on the communication link must be switched to the ON position.

CAUTION

The communication address of the inverter must not conflict.

Step 3 After connecting the cable, tighten the external forced cable fixing head, seal with fireproof mud and install the cover plate.

----End

3.7 Check the Installation

After installation, check the following items:

- Check if the connection in the DC input, AC output and communication wire are right.
- Check if the inverter is installed firmly.
- Check if all the screws in the crust of inverter are tightened.

4 Startup and Shutdown

This chapter mainly introduces how to start and shut down the inverter.

4.1 Start Inverter

Step 1 Switch on the DC switch in the inverter and the DC switch in the project site. When the PV array provides enough startup voltage, PV connection indicator will be on.

Step 2 Switch on the AC switch between inverter and grid, the fault indicator is off.

Step 3 If the DC and AC supply power normally, the inverter will prepare to start.

Step 4 A moment later, the inverter will generate power normally. The grid connection indictor will be on.

----End

4.2 Shut Down Inverter

WARNING

When the inverter is in normal operation, it is strictly prohibited to disconnect the DC and AC side switches under load to avoid the risk of arc damage to the switch. In severe cases, the inverter may be damaged.

Step 1 Switch off the DC switch in the inverter and the DC switch in the project site. A moment later, PV connection indicator will be off.

Step 2 Disconnect the connection between inverter and grid.

----End

5 Maintenance and Troubleshooting

This chapter mainly describes the maintenance and troubleshooting.

5.1 Maintenance

CAUTION

When maintenance or wiring, it should switch off DC switch.

In order for the inverter to work in the best condition, it is recommended to maintain it regularly.

- Debris or dust will affect the heat dissipation performance of the inverter, and can be cleaned with a soft brush.
- If the surface of the LED indicator is too dirty to read, you can clean it with a damp cloth.
- The external cooling fan is aeasy damage part. It is recommended to maintain it once a year. If the operating environment has large sand or thick dust, it is very necessary to shorten the maintenance cycle and increase the maintenance frequency.

Danger of High Temperature

During running, please don't touch the surface to avoid scald. Shut down inverter and wait until it cooling down, then do the maintenance.

CAUTION

Do not clean the device with any solvent, abrasive material or corrosive material.

NOTE

- When the power generation value displayed on the monitoring platform is inconsistent with the external measurement device, the user can correct the power generation value of the monitoring platform according to the Kehua communication protocol.
- The correction formula is: Total power generation compensation value = Measurement value of measurement instrument - Monitoring platform displays the total power generation value.

5.2 Troubleshooting

The inverter is designed on the basis of the grid-tied operation standards and meets the requirements of safety and EMC. Before provided to client, the inverter has been experienced for several rigorous tests to ensure reliable and optimizing operation.

If some faults occur, the touch screen will show the corresponding alarm information. Under the circumstances, the inverter may stop power generation. The fault situation is as shown in Table5-1.

Table5-1 Fault situation

NO.	Fault information	Deal way
1	Abnormal grid voltage	Check whether the safety regulations of the inverter meet the requirements of the local grid connection and check the voltage of the local power grid. If the above is normal, please contact your local agency or service center.
2	Abnormal grid frequency	Check whether the safety regulations of the inverter meet the requirements of the local grid connection and check the frequency of the local power grid. If the above is normal, please contact your local agency or service center.
3	Output current over-current	If the fault persists, please contact your local agency or service center.
4	Abnormal DC component of output current	If the fault persists, please contact your local agency or service center
5	Abnormal leakage current	Check the insulation resistance of the positive and negative poles of the battery board to the ground; check whether the environment around the inverter is wet; check the grounding of the inverter. If the above is normal, please contact your local agency or service

NO.	Fault information	Deal way
		center.
6	Relay failure	If the fault persists, please contact your local agency or service center.
7	Radiator over-temperature	Check whether the radiator of the inverter is blocked, and check whether the ambient temperature of the inverter is too high or too low. If the above is normal and the fault still exists, please contact your local agency or service center
8	Insulation impedance abnormal	Check the insulation resistance of the positive and negative poles of the battery board to the ground; check whether the environment around the inverter is wet; check whether the grounding point inside the inverter is loose. If the above is normal, please contact your local agency or service center
9	Fan abnormal	If the fault persists, please contact your local agency or service center
10	Over-temperature of cabinet inside	Check whether the radiator of the inverter is blocked, and check whether the ambient temperature of the inverter is too high or too low. If the above is normal and the fault still exists, please contact your local agency or service center.
11	MPPT x over-voltage	Check the system battery board configuration, if the above is normal, please contact your local agency or service center
12	MPPT x over-current	If the fault persists, please contact your local agency or service center
13	Branch x over current	Check the system battery board configuration, if the above is normal, please contact your local agency or service center
14	Branch x reverse connection	Check whether the branch x is connected in reverse, if the above is normal, please contact your local agency or service center
15	Inner abnormal	If the fault persists, please contact your local agency or service center

CAUTION

If the inverter has an alarm mentioned in Table5-1, please shut down inverter(refer to **4.2 Shut Down Inverter**), 5 minutes later, restart the inverter (refer to **4.1 Start Inverter)**. If the alarm status is not removed, please contact our local agency or service center. Before contacting us, please prepare the following information.

1. Inverter S/N.
2. Distributor/ dealer of the inverter(if has).
3. The date of grid-tied power generation.
4. Problem description.
5. Your detail contact information.

6 Package, Transportation, Storage

This chapter mainly describes the package, transportation and storage.

6.1 Package

The package of product is carton. When packing, pay attention to the placing direction requirements. One side of carton, it should print warning icons, including keep dry, handle with care, up, stacking layer limit, etc. The other side of carton, it should print the device model, etc. Print the logo of Kehua company and device name on the front of carton.

6.2 Transportation

Pay attention to the warnings on the carton. Don't impact severely when transportation. In case of damaging device, it should follow the placing direction that shows on the carton. Don't carry device with the objects that inflammable, explosive, or corrosive. Don't put device in the open-air warehouse when transshipment. Leaching and mechanical damage by rain, snow or liquid objects is prohibited.

6.3 Storage

When storing device, it should follow the placing direction that shows on the carton. The gap is 20cm between the carton and ground and the clearance is at least 50cm from carton to wall, heat source, cold source, windows or air inlet.

The storage environment temperature is -40℃～70℃. If storing or transporting device beyond the working temperature, before startup, set it alone and wait for the temperature reaches to the range of the working temperature and keep the status more than four hours. In warehouse, It's prohibited that there has poisonous gas, objects that inflammable and explosive, corrosive chemical objects. Besides, it shouldn't have too strong mechanical shaking, impact and strong magnetic field. Under the storage conditions above, the storage period is six months. If it is beyond six months, it has to recheck.

A Technical Specifications

A.1 SPI175K-B-H

Items	Min.	Typical	Max.	Illustration
Max. PV input voltage(Vdc)	500	-	1500	-
MPPT working voltage with full load(Vdc)	860	-	1300	-
PV connected/ MPPT tracking	18/9			
DC current of each route(A)	0	9	15	-
PV input power(kW)	0	175	193	-
Startup voltage(V)	-	550	-	
Grid features				
Output power(kW)	-	175	193	-
Rated grid voltage(Vac)	800V(3P3W)			
Grid voltage range(Vac)	720	800	880	Settable (If it is necessary to set the parameter, please contact the manufacturer.)
Frequency range(Hz)	48	50	50.5	Settable (If it is necessary to set the parameter, please contact the manufacturer.)
Grid-tied inverting efficiency	-	-	99.0%	-

Items	Min.	Typical	Max.	Illustration
Grid-tied China efficiency	-	-	98.4%	-
Grid-tied current harmonic	-	-	3%	Under full-load
Power factor range	0.8 (ahead)	1	0.8 (lag)	-
Current DC component	<631mA			-
Output current (A)	-	-	139.3	-
Protection grade(IP)	IP66			-
Isolation type	No isolation			With no transformer, the input cannot be connected with ground, or the grounding output must be with isolation transformer.
Heat dissipation way	Smart wind-cooling			-
Noise	<75±2dBA@1m			Do not install in a noise-sensitive environment
Display way	LED indicator			-
Communication port	RS485/ Ethernet/ WIFI(optional)/ GPRS(optional)/ PLC(optional)			
Operation temperature(℃)	-35	25	60	-
Storage temperature(℃)	-40	25	70	-
Relative humidity	0%	-	100%	-
Atmosphere(KPa)	70	106	-	-
Altitude(m)	0	-	4000	When the altitude exceeds 3000m, it is necessary to decrease rated power to use.

A.2 SPI200K-B-H

Items	Min.	Typical	Max.	Illustration
Max. PV input voltage(Vdc)	500	-	1500	-
MPPT working voltage with full load(Vdc)	860	-	1300	-
PV connected/ MPPT tracking	24/12			
DC current of each route(A)	0	9	15	-
PV input power(kW)	0	220	220	-
Startup voltage(V)	-	550	-	
Grid features				
Output power(kW)	-	200	220	-
Rated grid voltage(Vac)	800V(3P3W)			
Grid voltage range(Vac)	720	800	880	Settable(If it is necessary to set the parameter, please contact the manufacturer.)
Frequency range(Hz)	48	50	50.5	Settable(If it is necessary to set the parameter, please contact the manufacturer.)
Grid-tied inverting efficiency	-	-	99.0%	-
Grid-tied China efficiency	-	-	98.4%	-
Grid-tied current harmonic	-	-	3%	Under full-load
Power factor range	0.8 (ahead)	1	0.8 (lag)	-
Current DC component	<721mA			-

Items	Min.	Typical	Max.	Illustration
Output current (A)	-	-	158.8	-
Protection grade(IP)	IP66			-
Isolation type	No isolation			With no transformer, the input cannot be connected with ground, or the grounding output must be with isolation transformer.
Heat dissipation way	Smart wind-cooling			-
Noise	<75±2dBA@1m			Do not install in a noise-sensitive environment
Display way	LED indicator			-
Communication port	RS485/ Ethernet/ WIFI(optional)/ GPRS(optional)/ PLC(optional)			
Operation temperature(℃)	-35	25	60	-
Storage temperature(℃)	-40	25	70	-
Relative humidity	0%	-	100%	-
Atmosphere(KPa)	70	106	-	-
Altitude(m)	0	-	4000	When the altitude exceeds 3000m, it is necessary to decrease rated power to use.

A.3 SPI225K-B-H

Items	Min.	Typical	Max.	Illustration
Max. PV input voltage(Vdc)	500	-	1500	-
MPPT working voltage with full load(Vdc)	860	-	1300	-

Items	Min.	Typical	Max.	Illustration
PV connected/ MPPT tracking	24/12			
DC current of each route(A)	0	9	15	-
PV input power(kW)	0	225	247.5	-
Startup voltage(V)	-	550	-	
Grid features				
Output power(kW)	-	225	247.5	-
Rated grid voltage(Vac)	800V(3P3W)			
Grid voltage range(Vac)	720	800	880	Settable (If it is necessary to set the parameter, please contact the manufacturer.)
Frequency range(Hz)	48	50	50.5	Settable (If it is necessary to set the parameter, please contact the manufacturer.)
Grid-tied inverting efficiency	-	-	99.0%	-
Grid-tied China efficiency	-	-	98.4%	-
Grid-tied current harmonic	-	-	3%	Under full-load
Power factor range	0.8 (ahead)	1	0.8 (lag)	-
Current DC component	<812mA			-
Output current (A)	-	-	162.4	-
Protection grade(IP)	IP66			-
Isolation type	No isolation			With no transformer, the input cannot be connected with

Items	Min.	Typical	Max.	Illustration
				ground, or the grounding output must be with isolation transformer.
Heat dissipation way	Smart wind-cooling			-
Noise	<75±2dBA@1m			Do not install in a noise-sensitive environment
Display way	LED indicator			-
Communication port	RS485/ Ethernet/ WIFI(optional)/ GPRS(optional)/ PLC(optional)			
Operation temperature(℃)	-35	25	60	-
Storage temperature(℃)	-40	25	70	-
Relative humidity	0%	-	100%	-
Atmosphere(KPa)	70	106	-	-
Altitude(m)	0	-	4000	When the altitude exceeds 3000m, it is necessary to decrease rated power to use.

A.4 SPI250K-B-H

Items	Min.	Typical	Max.	Illustration
MPPT input voltage(Vdc)	500	-	1500	-
MPPT working voltage with full load(Vdc)	860	-	1300	-
PV connected/ MPPT tracking	24/12			
DC current of each route(A)	0	9	15	-
PV input power(kW)	0	250	275	-

Items	Min.	Typical	Max.	Illustration
Startup voltage(V)	-	550	-	
Grid features				
Outputpower(kW)	-	250	275	-
Rated grid voltage(Vac)	800V(3P3W)			
Grid voltage range(Vac)	720	800	880	Settable (If it is necessary to set the parameter, please contact the manufacturer.)
Frequency range(Hz)	48	50	50.5	Settable (If it is necessary to set the parameter, please contact the manufacturer.)
Grid-tied inverting efficiency	-	-	99.0%	-
Grid-tied China efficiency	-	-	98.4%	-
Grid-tied current harmonic	-	-	3%	Under full-load
Power factor range	0.8 (leading)	1	0.8 (lagging)	-
Current DC component (mA)	<902			-
Output current (A)	-	-	180.4	-
Protection grade (IP)	IP66			-
Isolation type	No isolation			With no transformer, the input cannot be connected with ground, or the grounding output must be with isolation transformer.
Heat dissipation way	Smart wind-cooling			-
Noise	<75±2dBA@1m			-

Items	Min.	Typical	Max.	Illustration
Display way	LED indicator			-
Communication port	RS485/ Ethernet/ WIFI(optional)/ GPRS (optional) / PLC(optional)			
Operation temperature (℃)	-35	25	60	-
Storage temperature (℃)	-40	25	70	-
Relative humidity	0%	-	100%	-
Atmosphere (kPa)	70	106	-	-
Altitude (m)	0	-	4000	When the altitude exceeds 3000m, it is necessary to decrease rated power to use.

- Specifications are subject to change without prior notice.

B Acronyms and Abbreviations

A

AC	Alternating Current

D

DC	Direct Current

L

LCD	Liquid Crystal Display
LED	Light-emitting Diode

M

MPPT	Maximum Power Point Tracking

P

PE	Protective Earthing
PV	Photovoltaic

R

RS485	Recommend Standard485

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